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THE INTERNATIONAL INSTITUTE OF AGRICULTURE

Origin of the Institute and Summary of the International Treaty

The International Institute of Agriculture was established under the International Treaty of 7 June 1905, which was ratified by forty governments. Twenty-two other governments have since adhered to the Institute.

It is a Government institution in which each country is represented by delegates. The Institute is composed of a General Assembly and a Permanent Committee.

The Institute, always confining its attention to the international aspect of the various questions concerned, shall :

(*a*) collect, study and publish as promptly as possible, statistical, technical, or economic information concerning farming, vegetable and animal products, trade in agricultural produce, and the prices prevailing in the various markets ;

(*b*) communicate the above information as soon as possible to those interested ;

(*c*) indicate the wages paid for farm work ;

(*d*) record new diseases of plants which may appear in any part of the world, showing the regions infected, the progress of the diseases, and if possible, any effective remedies ;

(*e*) study questions concerning agricultural co-operation, insurance and credit from every point of view; collect and publish information which might prove of value in the various countries for the organization of agricultural co-operation, insurance and credit ;

(*f*) submit for the approval of the various governments, if necessary, measures for the protection of the common interests of farmers and for the improvement of their condition, utilizing for this purpose all available sources of information, such as resolutions passed by international or other agricultural congresses and societies, or by scientific and learned bodies, etc.

WEIGHTS, MEASURES AND MONEY OF THE VARIOUS COUNTRIES WITH THEIR ENGLISH EQUIVALENTS.

1 Archine (Russia)	=	27.99961	inches
1 Ardeb (Egypt)	=	5.44435	bushels
1 Ardeb of wheat (Egypt)	=	2.95264	cwt.
1 Ardeb of hulled maize (Egypt)	=	2.75580	cwt.
1 Ardeb of barley (Egypt)	=	2.36211	cwt.
1 Ardeb of undecorticated rice (Egypt)	=	5.72812	cwt.
1 Ardeb of decorticated rice (Egypt)	=	3.83843	cwt.
1 Arpent (Canada)	=	0.84501	acres
1 Are [100 square metres]	=	107.63915	square feet
1 Arroba (Brazil)	=	33.06951	lbs.
1 Arroba (Cuba, Guatemala, Paraguay, Peru)	=	25.35841	lbs.
1 Arroba (Mexico)	=	25.36687	lbs.
1 Bale of cotton (Brazil)	=	396.83415	lbs.
1 Bale of cotton (United States)	=	500	lbs. (gross)
1 " " " " "	=	478	lbs. (net)
1 Bale of cotton (India)	=	400	lbs.
1 Barrel of wheat flour (Canada, United States)	=	1.75001	cwt.
1 Bar, see Millier			
1 Bow (Java, Dutch Indies)	=	76.36998	square feet
1 Bushel (United States)	=	0.96896	bushels (Impl.)
1 Bushel of oats (United States)	=	32	lbs.
1 Bushel of oats (Canada)	=	34	lbs.
1 Bushel of wheat or potatoes (United States)	=	60	lbs.
1 Bushel of barley (Canada, United States)	=	48	lbs.
1 Bushel of rough rice (United States)	=	45	lbs.
1 Bushel of rye, shelled maize, linseed (Canada, United States)	=	56	lbs.
1 Cadastral arpent (Hungary)	=	1.42201	acres
1 Cental	=	100	lbs.
1 Centiare [10 square metres]	=	10.76392	square feet
1 Centigramme	=	0.15432	grains
1 Centilitre	=	0,0022	gallons
1 Centimetre	=	0.393715	inches
1 Centistere	=	0.35315	cubic feet
1 Centner (Germany, Austria, Denmark)	=	110.23171	lbs.
1 Centner (Sweden)	=	93.71238	lbs.
1 Cho [60 ken] (Japan)	=	119.30327	yards
1 Cho (Japan)	=	2.45068	acres
1 Crown [100 heller] (Austria-Hungary)	=	10*d*	at par
1 Crown [100 öre] (Denmark, Norway, Sweden)	=	1s 1⅛*d*	at par
1 Cubic centimetre	=	0.06102	cubic inches
1 Cubic metre	=	1.30795	cubic yards
1 Decagramme [10 grammes]	=	0.35275	oz.

1 Decalitre [10 litres]	=	2.19976 gallons
1 Decametre [10 metres]	=	32.80840 feet
1 Decare [1000 square metres]	=	1195.98627 square yards
1 Decastere [10 cubic metres]	=	13.07951 cubic yards
1 Deciare [10 square metres]	=	11.95986 square yards
1 Deciatine [2 tchetwert] (Russia)	=	2.69966 acres
1 Decigramme	=	1.54323 grains
1 Decilitre	=	0.022 gallons
	=	0.0027497 bushels
1 Decimetre	=	3.93701 inches
1 Decistere	=	3.53146 cubic yards
1 Dinar, gold [100 para] (Serbia)	=	9 $^{23}/_{64}$ *d* at par
1 Dollar, gold, $ [100 cents] (United States)	=	4 *s* 1 $^{5}/_{16}$ *d* at par
1 Drachm, gold [100 lepta] (Greece)	=	9 $^{23}/_{64}$ *d* at par
1 Dz. = Doppelzentner (Germany)	=	220.46341 lbs.
1 Egyptian kantar (ginned cotton)	=	99.04980 lbs.
1 Feddan Masri [24 Kirat Kamel] (Egypt)	=	1.03805 acres
1 Florin, gold, or Gulden [100 cents] (Netherlands)	=	1 *s* 7 $^{23}/_{64}$ *d* at par
1 Franc [100 centimes] (France)	=	9 $^{23}/_{64}$ *d* at par
1 Gallon (United States)	=	0.83270 gallons (Im.)
1 gramme	=	0.03527 oz.
1 Hectare [10 000 square metres]	=	2.47109 acres
1 Hectogramme (100 grammes)	=	3.52746 oz.
1 Hectolitre [100 litres]	=	21.99755 gallons
	=	2.74967 bushels
1 Hectometre [100 metres]	=	109.36133 yards
1 Hectostere [100 cubic metres]	=	130.79505 cubic yards
1 Jarra (Mexico)	=	7.22642 quarts
1 Kadastral hold, see Cadastral arpent		
1 Kin (Japan)	=	1.32278 lbs.
1 Kokou [10 to] (Japan)	=	1.58726 quarts
1 Kokou of oats (Japan)	=	1.55014 cwt.
1 Kokou of cocoons (Japan)	=	82.67268 lbs.
1 Kokou of wheat and maize (Japan)	=	2.58356 cwt.
1 Kokou of barley (Japan)	=	2.06685 cwt.
1 Kokou of naked barley (Japan)	=	2.69428 cwt.
1 Kokou of rice (Japan)	=	2.80501 cwt.
1 Kopek (Russia)	=	1 $^{3}/_{100}$ farthing at par
1 Kwan (Japan)	=	8.26738 lbs.
1 Lei, gold [100 bani] (Rumania)	=	9 $^{23}/_{64}$ *d* at par
1 Leu [100 statinki] (Bulgaria)	=	9 $^{23}/_{64}$ *d* at par
1 Lira [100 centesimi] (Italy)	=	9 $^{23}/_{64}$ *d* at par
1 Litre	=	0.21998 gallons
	=	0.0275 bushel
1 Manzana (Nicaragua, Guatemala)	=	1.72665 acres
1 Mark [100 Pfennige] (Germany)	=	11 $^{3}/_{4}$ *d* at par
1 Mark [100 penni] (Finland)	=	9 $^{23}/_{64}$ *d* at par

1 Maund Factory (India)	=	74.6709 lbs.
1 Maund Imperial (India)	=	82.28136 lbs.
1 Metre	=	3.28084 feet
1 Milliare	=	1.07639 square feet
1 Milligramme	=	0.01543 grains
1 Millilitre	=	0.00022 gallons
1 Millimetre	=	0.03937 inches
1 Millistere	=	61.02361 cubic inches
1 Myriagramme [10 000 grammes]	=	22.04634 lbs.
1 Myrialitre [10 000 litres]	=	2 199.75539 gallons
	=	274.96701 bushels
1 Myriametre [10 000 metres]	=	6.21373 miles
1 Millier [1 000 000 grammes]	=	19.68426 cwt.
1 Milreis, gold (Brazil)	=	2s 2 61/64 d at par
1 Milreis, gold (Portugal)	=	4s 5 19/64 d at par
1 Minot (Canada)	=	1.07306 bushels
1 Morgen (Union of South Africa)	=	2.11654 acres
1 Muid (» » »)	=	24 gallons
	=	3 bushels
1 Oka (Greece)	=	2.75579 lbs.
1 Oke (Egypt)	=	2.75138 lbs.
1 Peseta, gold [100 céntimos] (Spain)	=	9 35/64 d at par
1 Peso, gold [100 centavos] (Argentina)	=	3s 11 37/64 d at par
1 Peso, gold [100 centavos] (Chili)	=	1s 5 43/64 d at par
1 Pic (Egypt)	=	2.46646 feet
1 Pikul (China)	=	133.27675 lbs.
1 Pikul (Japan)	=	132.27805 lbs.
1 Poud (Russia)	=	36.11292 lbs.
1 Pound, Egyptian, gold [100 piastres]	=	£1. 0. 6 45/64 at par
1 Pound, Turkish, gold [100 piastres] (Ottoman Empire)	=	18s 0 61/64 d at par
1 Pund (Sweden)	=	0.93712 lbs.
1 Quintal	=	1.96843 cwt.
1 Rouble, gold [100 kopeks] (Russia)	=	2s 1 9/16 d at par
1 Rupee, silver [16 annas] (British India)	=	1s 4 d at par
1 Square metre	=	1.19599 square yards
1 Stere [1 cubic metre]	=	1.30795 cubic yards
1 Sucre, silver (Ecuador)	=	1s 11 51/64 d at par
1 Talari [20 piastres] (Egypt	=	4s 1 13/64 d at par
1 To (Japan)	=	0.49601 bushels
	=	3.96815 gallons
1 Ton (metric)	=	0.98421 tons
1 Verst (Russia)	=	1166.64479 yards
1 Yen, gold [2 fun or 100 sen] (Japan)	=	2s 0 17/64 d at par
1 Zentner (Germany)	=	110.23171 lbs.

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the final products of its disintegration there comes a series of intermediate products that are often of crystalline structure. This process is best observed in the alteration of the micas ; the latter undergo a progressive modification until they reach kaolinite, and all the intermediate products are clearly crystalline.

My own analyses of decomposing micas have definitely shown the basal metal to be gradually replaced by hydrogen ; the micas are transformed into acid salts leaving as a residue kaolinite.

Among the decomposition products of biotite, there is found in addition to kaolin, the quartz resulting from the breaking up of the olivine groups which occurs according to VERNADSKY (Member of the Academy), in the lateral chain of the biotite and has the formula $(KH)_2$ $(Al\ Fe)_2$ Si_2O_8 $(Mg.Fe)_2$ $Si\ O_4$.

Naturally, the final product of muscovite is kaolin (without quartz), hence the kaolin scales derived from muscovite can be distinguished from those derived from biotite.

The same principle governs the decomposition of the other alumino-silicates that form the salts of the group of micaceous acids such as the nepheline group, the garnets, epidotes, vesuvianite, leucite, the feldspars, scapolite etc.

The minerals containing at the same time alumino-silicates and the mica group, or alumina-silicates and the chloritoid group (TSCHERMAKS' silicate), decompose in quite another manner. They are pyroxenes and amphiboles containing alumina and forming three groups of isomorphic mixtures : the metasilicates ($R''\ Si\ O_3$), the alumino-silicates with the mica group $R'\ (Al\ Fe)_2\ Si_4\ O_{12}$ and the chloritic group, or TSCHERMAK's silicate ($R''\ Al_2\ Si\ O_6$).

The clay which is the final product of the alteration of minerals differs perceptibly from kaolin, in constitution, optic properties and its greenish-grey colour. This clay goes by the name of *anauxite.*

Previous to the formation of anauxite a whole series of intermediate acid salts are found.

The final decomposition of zeolites is halloysite, which also precedes acid salts.

As regards the group of the chlorites which, according to VERNADSKY, are the salts of chloritic acid, the question of the final products of their decomposition is not yet clear ; no doubt however, they are also transformed into clay, though we know nothing of the nature of the latter. The researches of Prof. ZE-

MIATSCHENSKY (1) on clinochlorite show that it is easily hydrolysed with the formation of acid salts, but needless to say, only the first products of decomposition can be obtained in the laboratory.

The silicates that do not contain oxides of the type R_2O_3 are the salts of silicic acid, generally the ortho and meta acids. In altering, these form more and more acid salts (serpentine, talc, etc.), their final residue being a free acid, or rather its anhydride, in the form of quartz.

Such is the simple scheme of the alterations taking place in the silicates, or alumino-silicates, of soil. If, however, as occurs in the tropics, the process of decomposition is very energetic, the clays also become decomposed. We do not at present know how the aluminium is split off and are obliged to content ourselves with more or less probable hypotheses.

In this connection, we may observe that, by the action of distilled water, or of water saturated with carbon dioxide, it has been found possible to produce, in the laboratory not only the hydrolytic decomposition of the alumino-silicates, in which case hydrogen replaces the metal of the base, but also the liberation of small quantities of alumina (2). Probably this is due to small amount of the silicate of aluminium being dissolved by the caustic alkali, or carbonate, which under experimental conditions, is often left for some time in contact with the mineral being analysed.

The above data show clearly that the *characteristic* minerals forming the natural components of soils are not constant in their composition ; they form a group of compounds to which FERSMAN (3) has applied the term *mutable*.

Since humus is composed of a group of substances that are still more instable and inconstant, it may certainly be asserted that the soil should be called the kingdom of mutable compounds.

In analysing the decomposition processes, it must not be forgotten that the alteration of minerals, like the disintegration of organic substances, takes place with an unequal degree of intensity, being

(1) ZEMIATSCHENSKY. Etude sur les argiles russes. (Study on Russian Clays). *Travaux de la Section des matériaux argileux de la Commission de l'investigation des richesses naturelles de la Russie, à l'Académie des Sciences.* Petrograd, 1923.

(2) See, MIYAKE, H., in *Tokyo Imperial Mineral. & Petrograph. Institution*, Part I, 1914, and among the recent investigators DAIKUHARA in the *Bulletin of the Imp. Central Agric. Station Japan*, 1914, Vol II, No. 1.

(3) FERSMAN, A. Composés mutables dans l'écorce terrestre. *Recueil en l'honneur du 25e anniversaire du travail scientifique de* W. I. VERNADSKY, Moscow, 1914

influenced by different external conditions, chiefly climatic factors, hence the alteration products of minerals cannot be the same in zones with different climates.

Therefore, given the variety in the character of humus and in the substances produced by the alteration of the minerals, we might presuppose that *several types of soil formation* would exist on the surface of the earth, and indeed, we know 5 *different ways* in which soils are formed.

It is self-evident that these types being formations of a geographical character cannot be clearly marked off from one another. They form a series of transition soils, for which reason we may find many varieties within the region of each type.

What has already been said proves that every type possesses its special rate of decomposing organic substances and of disintegrating minerals.

Each type is able to retain, or to lose by elimination, any product of either process ; it therefore results that every soil acquires characters and individual properties, amongst others its morphology (colour, structure, texture etc.), for it is indisputable that the morphology of a soil is only one of the effects of the process of its formation.

The types mentioned above are :

1) the laterite type ;
2) the " podsol " type ;
3) the steppe soils type.
4) the " solonetz " type ;
5) the type of marsh soils with the sub-type of saline soils, or " solontschaks ".

The following is a concise summary of each of these types :

LATERITE TYPE. — The energy of the decomposition of the organic matter is intense, resinous and waxy substances alone resisting disintegration. The soil retains little humus which, on account of its not being saturated with absorbed bases, easily passes into the condition of mould.

The alteration of the alumino-silicates is complete leaving as a residue free silicates of aluminium ; the hydrates of iron and of manganese and titanic acid accumulate.

The bases (alkalis and alkaline earths), and the silica of the silicates are energetically leached.

" PODSOL " TYPE (see Table I, fig, 1). — The decomposition of the organic detritus is less rapid than in the preceding case. The

humus accumulates in large quantities, but is not saturated with bases (lime especially being deficient), thus it easily passes into the condition of "soil". The "soils" derived from humus, together with the hydrates of the sesquioxides of iron, manganese, and to some extent, those of aluminium, form the *alios* ("Ortstein"). The "soils" of the humus, which in the present case play the part of preservative colloids, draw down into the lower layers the muddy matters in suspension. Therefore the upper strata are coarser in texture and become rich in silica, whereas those that are more deeply seated, where the muddy matter is arrested, become viscous and compact.

The decomposition stops at the formation of acid silicates and alumino-silicates; the clay seems to collect in minimum quantities.

Steppe soil type. — The decomposition of organic detritus is slow; the humus accumulates, and being saturated with lime, moves little. Its immovability causes the arrest of the muddy matter which does not filter from one layer into another.

If the lime with which the soil was saturated were washed by increasing moisture, the humus would become more distributed and would gradually change into "podsolic" soil. This process, which has been studied in the tchernosem, where forest vegetation has encroached, is termed *degradation*.

The salts resulting from the processes of humification and disintegration are not entirely washed out. The less soluble compounds (carbonate and sulphate of lime), are retained in considerable quantities in the subsoil, and sometimes even in the superficial layers.

The silicates and alumino-silicates undergo little alteration, only slightly acid salts and no clays being formed, therefore the steppes are always rich in bases.

"Solonetz" type. — In this type of soil (see Table II, fig. 2), the decomposition of organic remains is less intense than in the steppe soils, but as its humus is saturated with sodium, the process takes place in an alkaline medium. The presence of ions $(OH)'$, promotes the passage of the clayey matter from the superficial strata to the deeper-seated layers, hence the former become rich in quartz and silica and the latter in alumina, and in the hydrates of iron and of manganese.

The alteration process goes on more energetically than in steppes soil, but on account of the alkalinity of the solutions, the alumino-silicates are partially dissolved.

MARSH SOIL TYPE. — Decomposition is hindered by the excess of moisture. The organic remains collect in the form of peat, that is to say, their carbon content becomes higher. The lack of oxygen contributes to the formation of ferrous compounds, such as $Fe\ CO_3$ $Fe_3\ (PO_4)_2$, $8\ H_2O$ Fe S Fe SO_4, and other sulphates and even oxalates.

The alteration may be more energetic owing to the substances being continually in contact with water ; further, the formation of clays, as well as the partial solution of the alumino-silicates, may also take place. The marsh soils of Europe and of North Asia, can be regarded as manganese-ferruginous " solontschaks ". Towards the south (in the pre-steppes), they are replaced by carbonate " solontschaks ", and still further south, by sulphate, haloid and mixed " solontschaks ".

These are the principles upon which I have determined 5 types of soil formation ; let us now pass on to a more detailed description of their varieties.

LATERITE TYPE.

1) Laterite soils in which the characters of the type are very pronounced.

2) The red soils of tropical regions ; in these, the type characters are less distinct.

3) The " Red Soil " of latitudes with a warm, but temperate, climate ; the type characters are still less marked.

4) Yellow soils transitional between the laterite and the " podsol " types (Southern France, Central Japan).

PODSOL TYPE.

A. — Primitive podosolic soils.

1) The brown soils of Prof. RAMANN. — These mark the first step in the transition from the laterite to the " podsol " type, and they occur within the limits of the latter.

2) *The forest " podsolic " soils* which are divided into " podsol " soils, podsolic soils, slightly podosolic soils, and dissimulated " podsol " soils (variety found in the northern regions).

The " podsols " have a discoloured, very distinct whitish layer A_2. The horizon coloured by humus, A_1, is often scarcely noticeable, but the horizon B, where the products of leaching are arrested, is

clearly to be distinguished. The " alios " (" Ortstein "), is always present.

In the podsolic soils, the horizon A_2 and B are less distinct, and the " alios " rarely forms. The slightly podsolic soils have no horizon A_2, which is usually replaced by separate bluish patches, although sometimes even these are absent.

The northern dissimulated podsol soils (Russia in Asia), possess all the horizons of the podsolic soils, but they are not clearly marked off, and can therefore only be recognised with difficulty. In the north-east of Russia in Europe (Murmanian Coast), dwarf podsolic soils are formed ; in these all the horizons are distinct, but very thin.

3) *Podsolic meadow soils.* — The horizon A_1, is clear and somewhat thick ; horizon A_2 is always of a dirty grey colour ; the " alios " nearly always forms. Between the meadow soils and the tchernosem, come the transition soils known by the name of pseudo-tschernosem (in Western Siberia). Thus with this soil group are connected the *mountain meadow soils* amongst which are sometimes found soils passing into the tschernosem.

4) *Peaty podsolic soils and " gley " podsolic soils* (1). — The upper layers are peaty ; horizons A_1 and A_2 are always distinct. Horizon B, is lacking in " gley " podsolic soils ; its place is filled by a " gley " horizon representing a deoxidised variety, that is to say, a soils containing protoxides of iron, and of a greenish, bluish, or greyish colour ; it is formed by the action of the subterranean water-table.

B. — Podsolic Soils of Secondary Origin.

5) *The secondary podsol* represents the last stage of disintegration ; horizon A_1 and A_2 have no structure, the first is grey and the second whitish. Horizon B is brown and rather thick, at its lower boundary the leached carbonates accumulate ; the " alios " is generally absent. In the clayey-sandy podsols, there occur beneath the humus-stained horizon, thin bands of " alios " that wind about in the ground, sometimes crossing one another (these are called pseudo-fibres).

6) *Clayey Soils of schistose and granular structure*, these are less disintegrated than the preceding soils. Horizon A_1 is grey and structureless ; horizon A_2 is whitish and schistose in its upper portion ;

1 : Cf. Dr E. RAMANN, *Bodenkunde und Bodenkultur*, pp. [illegible], Berlin, Verlag von Julius Springer, 1918. (*Ed.*)

FIG. 1. "Podsol" type of Clay soil in Smolensk.

FIG. 2. — "Solonetz" Soil type, in Woronega

further down, it assumes the form of hazel-nuts viz., of acute angled polyhedra. Horizon B, is brown and viscous, the carbonates collect in the underlying stratum.

7) *Disintegrated light-coloured soils.* — Horizon A_1 is grey and part of it is granular; horizon A_2 is lighter in shade, and has a structure resembling hazel-nuts; horizon B is brown and compact with prismatic-structure; the horizon beneath is rich in carbonates.

Under horizons A_1 and A_2 of the sandy-clays runs a system of narrow ramified bands of humus which are sometimes parallel, but at other times cross one another.

8) *Disintegrated dark coloured soils.* — Horizon A_1 is dark grey and granular throughout its entire thickness. Horizon A_2 is lighter in colour and forms hazel-nut structures; horizon B is dark brown being stained by the humus; its structure is prismatic; the carbonates are accumulated at its lower limit. The sandy-clay soils are traversed by wide bands of humus below horizons A_1 and A_2.

9) The disintegrated tschernosems represent the first and slight degree of alteration; the lower parts of the horizon stained by humus is discoloured and takes on a hazel-nut structure.

Podosolic soils of secondary origin have been found in the presteppes, as well as in the tschernosem steppes (Russia in Europe and Asia, Germany, Austria, Hungary and Rumania).

STEPPE SOILS TYPE.

A. — Tschernosem. — At the present time, the following varieties are distinguished: *leached* tschernosem, *thick* tschernosem, *ordinary* tschernosem, *southern* tschernosem, *Azov* tschernosem.

1) *Leached tschernosem.* — The horizon stained by humus is fairly thick, it is of granular structure; the granules are intermixed, however, with much larger fragments.

The underlying horizon is brown and free of carbonates which have been washed down to greater depths. This horizon seems to represent the beginning of the horizon where the leaching products collect in the podosolic soils.

2) In the *thick tschernosem*, the horizon coloured by humus is one metre, or more, thick. The clayey varieties are distinctly granular; on passing downwards, the particles become larger, and form clods. Immediately beneath the upper layer, there are carbonate containing soils that assume the form of fine interlacing fibres re-

sembling those of the mycelium of a hyphomycete and hence go by the name of *pseudomycelium*.

3) *Ordinary tschernosem*. — The horizon stained by humus attains a depth of 75-80 cm. The upper portion of the section has a granular structure which changes with the depth, as in the case of the preceding variety. The carbonates form efflorescences, round patches, etc. The soil is sometimes so much disturbed by burrowing animals, that it is impossible to distinguish the limits of the successive horizons in the section. Such soils are known as mole-heap (" krotovines ") tschernosem.

4) *Southern tschernosem*. — The humus-stained horizon is not more than 50-55 cm. thick ; the upper portion is frequently structureless, though sometimes it is laminated ; this horizon takes on a granular facies as it passes downwards, and clods are formed at the bottom. The carbonates occur in the form of round patches (" bieloglaska "). At a lower depth (1.5-2 m.), a horizon rich in gypsum occurs.

5) The *Azov tschernosem* (both here and in the steppes of the Northern Caucasus), is characterised by the great thickness (up to 150 cm.) of the horizon coloured by humus. This horizon is grey and possesses no special structure ; the carbonates appear almost at the surface and form an efflorescence composed of fine fibrous crystals that resemble cotton-wool.

The " regurs " of India seem also to belong to a variety of tschernosem (Regur, Regarda, Cotton Soil).

B. — Chestnut soils.

6) *Dark chestnut soils*. — The upper layer is of the colour of ripe chestnuts, which has gained for these soils their name of Dokoutschaef ; it has no definite structure. Its depth ranges from 55-60 cm. The first 5 cm. are schistose and lighter in colour than the rest of the soil. When dry, this soil breaks up into large prismatic clods. Below the humus-stained horizon, lie strata rich in carbonates and gypsum (Russia in Europe and in Asia, Hungary and Rumania).

7) *The light chestnut soils* are not as dark in colour as the soils just mentioned, and the upper layer is thinner. Their other morphological characters resembles those of the dark chestnut soils.

C. — Brownish soils : Two varieties of these may be distinguished as *dark brown soils* and *light brown soils*. As a whole, they are lighter than the chestnut soils. It is difficult in the case of the

light coloured variety to determine the junction of the humus stained horizon and the sub-jacent layer, but as a rule, the horizon coloured by humus is not so thick as in the case of the chestnut soils. The horizons of the carbonates and of the gypsum are always visible. These soils are formed in the south of the Government of Astrakan, in the Kirgis steppes and in north Turkestan.

D. — LIGHT-GREY SOILS containing carbonates right down from the surface and showing at a certain depth traces of the work of insects, worms, and sometimes of larger animals (serpents, tortoises). These soils occur in the south of Turkestan.

E. — RED SOILS OF THE DESERT STEPPES of the sub-tropical latitudes. These soils are found in the arid regions of north Africa, Kalahari, Mexico, Brazil, and Central Australia.

" SOLONETZ " TYPE.

1) *The " solonetz " soils* have generally the following facies : the upper layer is loose and often structureless ; sometimes it is divided into two parts : A_1, the darker, and A_2 whitish. Horizon B is dark and compact ; it forms masses with rounded tops, or prisms sometimes it takes the shape of polyhedra, or of irregular, formless clods. The leaching of the superficial layers is effected under the influence of the sodium ($Na_2 CO_3$) that is produced after the humus is saturated by the solutions of Na Cl and of $Na_2 SO_4$ (1).

The " solonetz " may be derived from " solontschaks " rich in sodium after the latter have been leached out (2), or they may be produced as a result of the leaching of the sodium salts that have found their way to the surface.

As a general rule, " solonetz " soils do not appear until after the tschernosem zone, but in the province of Yakutsk, they are even met with within the limits of the podosolic soils.

2) *Soils where the " solonetz " type is feebly represented.* — The difference in colour and compactness between the horizon A and B is clearly distinguishable, but horizon B has no well-defined structure. These soils result from a decline in the processes to which are due the formation of the " solonetz ".

Soils of the " solonetz " type are zonal within the limits of the

(1) GUILHOITZ C. in *Journal de l'Agron. expérim.* Vol. XIII, Part 3, 1912, p. 408.

(2) WILLENSKY D. Essai d'application de la methode géographique à la question de la formation des " solonetz ". *Bull. de la Stat. d'expér. de la région de Saratof*, Vol. III, Part 1, 1921.

central portion of the desert-steppes with moderate climate and of the zone of the chestnut soils, as well as north of the area occupied by the brown soils).

MARSH TYPE OF SOILS.

A. *Marsh soils properly so-called.*

1) Fresh-water marsh soils.

a) peaty soils;

b) clayey soils.

2) *Soils of sea-marshes* (swamps, coast soils covered with mangroves).

B. — " SOLONTSCHAKS ".

1) *Solontschaks containing carbonates.*

2) *Solontschaks containing sulphates* of which the variety known as *solontschak bouffis* has been the most studied. The superficial layer of these soils is dry and loose, it crumbles easily under the spade. It contains a large number of crystals of gypsum and of glauberite which in crystallising out removed a considerable amount of water from the soil.

3) The chloride " solontschaks, " of which the most important contain calcium chloride, are black and always damp.

4) The mixed " solontschaks " contain at the same time sulphate, chlorides and carbonates.

***

The above are the chief subdivisions of the classification I have established. Naturally, in each type and in its varieties, are to be found soils of different mechanical composition: clays, clay-sands, sandy-clays and sands. We know of soils derived from various kinds of rocks, for each type can be formed on any mineral substratum. Thus, we are acquainted with podosolic soils resting on clay, clay-sand, and sandy-clay subsoils, on granites, clay-schists, diabases, etc.; while tschernosems are formed on loess, Jurassic clays, granites, basaltic lava, etc.

By this enumeration, I wish once again to insist upon the fact that the parent-rock has only a secondary influence upon the process of soil formation which depends in the first instance upon external factors, climatic conditions being the most important.

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PHENOLOGY AND THE POSSIBILITIES OF ITS APPLICATION TO AGRICULTURE

Upon phenology, as an auxiliary of botany and of agriculture, devolves the task of determining all the connections existing between the course of the various phases of development that succeed one another according to fixed laws (during a single year in the case of annual plants, and during several years, in that of perennials), and of the correlations between plants, on the one hand, and the combined external factors of climate and soil on the other.

In order to arrive at a better understanding of the vital question with a view to enabling phenology to attain a far-reaching application to agriculture, it must always be borne in mind that this ancillary science, from its very nature, is concerned with two sets of factors : *a*) the plant, a living organism possessing inherited tendencies which form, so to speak, a large frame-work within which development must take place along certain definite lines : *b*) the forces of environment that operate either singly, or combined, according to their strength, and sequence in time, but always in certain directions and within clearly defined limits.

The functions of the plant, both separately and taken in conjunction, have at their disposal during this compulsory course of development, a certain range of potential variation which leaves them free to overstep the narrow limits imposed by inheritance and to attain, under the influence of environmental factors, a determined condition. Consequently, there exists in each plant a balance between inherited tendencies and the external forces surrounding it. Individuals of a like species have the same scope of adjustment, for their course of development is similar, especially when the representatives of the species grow within their natural range of distribution and the adjustment is effected, as in the case of wild plants, without any human intervention. It is just the attainment of this state of equilibrium that has enabled wild plants to hold their own against all competitors in certain natural habitats.

In other words, the spread of wild species to-day is due to the existence of a balance between these internal and external factors.

In the case of wild plants growing within their natural area of distribution, phenology has so far succeeded in establishing a connection between localities and similar phases in the development of a species and has inferred from this connection that the final result of the gradual and definite pressure of the environmental forces will be to produce the same, or a similar, physiological effect upon the germ plasm of plants of the same species and upon their capacity to maintain the above-mentioned state of equilibrium. The special physiological importance of these changes from the point of view of their application to practical agriculture will be dealt with in the following paragraphs and as an introduction, a brief survey will now be given of the present position of phenology in order to make clear the rôle of this valuable auxiliary of agriculture.

If the history of phenology during the last 50 years (approximately from 1870) is reviewed and the lines are kept in mind upon which it has developed and extended, first in connection with its parent science, botany, and later with the cultivation of agricultural plants, very interesting observations can be made.

Botanical phenology has chiefly confined itself to the study of wild plants, and has determined the isophanes for the germination and maturity of a large number of easily recognised plant species throughout the whole of Northern, Southern and Central Europe. These investigations also included researches regarding the intervals between the germination and maturity of a number of wild plants and of some cultivated plants, spring in Central Europe being considered as a phenological season and divided into several stages. In this way, phases on which to base a system of phytophenology were studied and the data thus obtained were employed for making phenological maps. An exhaustive study was made of the relation of these seasons to warmth, of the thermal growth constants and their physiological significance, while numerous phenological data referring to single species of plant were collected. Active relations with the borderland of Meteorology were maintained, for in several countries, phenology is chiefly regarded from the meteorological standpoint. These investigations sometimes extended to a certain degree to cultivated plants, rye as a *species* and even special stages of fruit and vine cultivation being studied phenologically.

On the other hand, a large amount of material relating to the cultivation of agricultural plants had already accumulated, particularly since the eighties of the past century. These data had been obtained from the observation of the various stages in the development of different *varieties* of cultivated plants and especially from plant-breeding and comparative cultural experiments with the *varieties* thus produced.

Unfortunately, the work was extended over too wide a field, and the method adopted had the further defect that whereas certain stages of growth which possessed a particular importance for the special purpose were exhaustively studied, the whole life-cycle characteristic of the different varieties was not taken into account in order to estimate the value of the variety from the physiological data obtained. The first comprehensive works published in German on the subject of cereal cultivation are Schmidt's " Über den Entwicklungsverlauf bei Getreide " (The Course of Development in Cereals), and Schneider's " Über den Entwicklungsrhytmus bei den Fruchtständen von Getreide " (Developmental Rhythm in the Fertile Culms of Cereals) and these show that the developmental side of the cultivation of agricultural crops has been the object of little thorough investigation and reveal a noticeable hiatas in the study of variation.

During the last century, less interest was taken in phenology generally than is deserved by the importance of the subject. This neglected is to be attributed on the one hand to the fact that new points of view were lacking, while the range of the old ones was practically exhausted, although on the other hand, the conviction forces itself upon us that phenology was not accorded its due position among the kindred branches of botany and in the study of agricultural crop-growing, seeing its importance to the correct understanding of the physiological functions governing the development of cultivated plants.

The chief aim of agriculture in recent years has been to establish the principles of physiological plant cultivation upon the basis of breeding and the laws of heredity. It is only lately since the study of variation has become the object of special attention, and it has been realised that the course of development peculiar to the individual varieties is of supreme importance as forming a scientific basis for the differences observed that phenology has received more attention.

Thus, within the ranks of agriculture itself, an ancillary science is arising, but so far no conscious application of its principle has been made, although they are identical with the well-established principles whose adoption has already met with conspicuous success in the case of botanical phenology which may be regarded as the parent of agricultural phenology.

We now find ourselves confronted with the interesting question, how is it that botanical phenology in the course of its natural development has not succeeded in building up for the benefit of agriculture a similar auxiliary science working on the same lines, but on a broader basis?

The chief reason of this discrepancy is the different manner in which botany and agriculture have dealt with the same material.

Botany hitherto has studied *species* of *wild plants* growing in their natural area of distribution and treated their stages of development mainly from the systematic and morphological standpoints.

Agriculture, on the other hand, has not occupied itself with species as a whole, nor even with sub-species, but has confined its attention to the *races* and *varieties* of the different *crop plants*, since successful issues from the agricultural point of view depend upon special performance in the field, that is to say, upon physiological and histological characteristics.

Therefore, the principles of botanical phenology when applied to agriculture failed in producing the expected and desired results, for the species is too rough a material to reveal the delicate shades of difference required by the agriculturist from his races and varieties. This is proved by the fact that this branch of phenology has actually been used in agriculture in just those cases where it was necessary to study the stages of development of *varieties*, which often happens in the cultivation of fruit-trees and vines.

This ought long ago to have shown that phenology as applied to agricultural crops can only be assured of a future if it does not confine itself to the study of species, but takes the race as the lowest unit for investigation and the starting point of all researches. But here again the separate stages of growth must not be considered apart from the life-cycle of the race as a whole, but the whole life-period extending over several years and compared with that of many other races must be taken into account in order for any just estimate to be possible. That the origin of the race is of great importance in such investigations is well-known to all students of the subject

The chief points in which the two branches of the science of phenology differ from one another and the elements on which they are based may be summarised as follows :

a) Botanical phenology deals with *species of wild plants* growing in their *natural* area of distribution (without any human interference).

b) Agricultural phenology takes as its lowest unit the *race* or *variety* of *cultivated plants* in their *area of agricultural distribution.*

The latter differs from the natural area inasmuch as it chiefly depends upon the economic needs of mankind (being altered to suit their requirements) and it usually includes only those portions of the natural area of distribution that occupy the central and most favourable zone of agricultural production (cultivation zone). The lower zone is not included, for on account of their poor agricultural performance there, the races in question are no longer cultivated in that zone.

If we examine, on the one hand, the effect so far exercised by botanical phenology upon agriculture and, on the other hand, the results obtained by agricultural phenology working independently, but in the same direction, and with the special method necessary for building up a system suited to its own requirements, we must confess that both branches of the science have paid too little heed to the parallel efforts of the other, and neither has recognised clearly the different basis upon which agricultural phenology must be developed, if it is to be used and applied in the field of the study of variety to the fullest extent.

It would be most advantageous for agricultural phenology to adopt from the old branch of botanical phenology any methods suitable to its purpose, provided due attention were paid to those details which both branches feel to be of fundamental importance.

The following paragraphs contain a brief account of the field of activity of agricultural phenology, describe the lines of its development, and give a glimpse of the opportunities awaiting this method of research in the domains of agriculture and more especially in the study of variation. Agricultural phenology is only a special method of applying botanical phenology, distinguished by the importance given to physiology.

In his hitherto unpublished work, " Der Sortenbau auf pflan-

zengeographischer Grundlage", the author has sought to show the elements on which must be based a scientific study of variation in the case of cereals first, and afterwards in that of all other cultivated plants. According to his view, there exist even amongst the varieties of our cultivated plants, xerophytic and hygrophytic types, as is shown by their anatomical structure with which are correlated certain physiological differences. These two types of plants grow in special areas clearly delimited by the plant-geographer, and even in the case of varieties the agricultural area of distribution is closely connected with the natural one and is divided into zones differentiated by the better or worse growth of the crops. These facts, together with a well-worked out variety-phenology, would supply the data necessary for estimating and determining the agricultural and physiological value of the varieties.

Now let us consider the real signification of agricultural phenology in the above connection :

It is well-known, that the course of development in a growth period varies in different variations according to the plant's geographical origin. Thus SCHMIDT, in his treatise which we previously mentioned is able to distinguish 6 important periods in the case of winter wheat, and 4 in that of summer wheat. The different cultivated plants change their development periods according to their needs. Therefore in order to make a final estimate of the value of different varieties, it is of paramount importance to study the rate at which one period passes over to another and the longer duration of certain parts of a period, since upon these physiological characters depends the superiority of one variety over another in certain districts. This specific difference in growth, as shown by the unequal time occupied by the various stages, is termed by SCHINDLER (" Handbuch des Getreidesbaus, " Seite 29) the " special development rhythm ". He attributes to certain varieties the power of passing rapidly out of special, weak conditions which, under the existing circumstances, would militate against, or even prevent, their ultimate success as agricultural crops. This property renders these varieties immune to certain diseases and enables them to smother certain formidable weed enemies by rapid growth at the right season. (HIESSLING). Further, this power of lengthening certain stages is often the real secret of the capacity possessed by these varieties of turning to account slight variations in the environmental factors, or soil conditions that is denied by

their inherited constitution to other varieties. The latter, impelled by internal causes to pass rapidly from one period to another, thereby forfeit the great advantage of being able to benefit by the propitious moments of development and are incapable of the slight physiological modifications that the agriculturist needs and according to which he estimates the value of the variety.

The great value of old, long-established native varieties, whether they have originated in the country, or are derived from the earliest cultivated types, lies in the fact that only they are able through their fixed characters, that have become stable by growing for a long time in the same place, to profit by the vicissitudes of the prevailing climate. The development rhythm peculiar to the variety has the capacity of adjusting itself to the hypogenic growth-rhythm and further, often also to the climate-rhythm of the district. The better the development-rhythm of an imported variety can adapt itself to the growth-rhythm and climate-rhythm of its new home, the greater is the agricultural success of the plant assured. (Compare also SCHARFETTER in "Der Österreichischen Botanischen Zeitschrift", 1922, Parts 7-9).

Any deviation on the part of a foreign variety from the development-rhythm of the native variety shows that the growth and climate-rhythms of its country of origin were different from those obtaining in its new home. Agricultural phenology can thus be used to determine the country of origin of varieties, just as SCHARFETTER has employed botanical phenology in tracing the origin of wild plants.

Agricultural phenology has also another important task in estimating the value of varieties by means of comparative cultural experiments. Within the natural and the agricultural areas of distribution of varieties which are clearly distinguishable owing to their belonging to a xerophytic or hygrophytic group and by the presence of certain correlations peculiar to the type, there occur in an area where the climate is changeable, differences in the development-rhythm that can serve as a basis upon which the different grades of the agricultural performance of the variety can be still further subdivided according to the zone in which the variety grows. The given variety will pass from the optimum zone of production first to an intermediate zone, and finally to the limit of profitable cultivation.

When the range of potential variation does not allow the inherited

tendencies and fixed course of the functions to adjust themselves to the pressure of the forces of environment, the agricultural performance of the variety will suffer in proportion as the latter is forced back to the lowest limits of this range, so that finally the variety sinks under the weight of unfavourable circumstances and is abandoned.

According to DRUDE it would also seem to be possible to subdivide the growth regions of wild plants better than it has hitherto been done by observing the slight differences in the development-rhythm of the different cultivated varieties and the manner it can be turned to account in agriculture, and by instituting a physiological comparison between the cultivated and the wild varieties. In his opinion, the North-Atlantic vegetation region could easily be subdivided by this means, as could also the mountain forest region of Central and Southern Germany and of Central France; this new method could also be applied — with special advantage from the agricultural standpoint — to the frequently over-lapping regions of vegetation in Switzerland and North Italy.

Space, however, unfortunately prevents our describing at length any special methods of work, or their practical application to agriculture. The attempt has been made merely to show the fundamental difference in the botanical and the agricultural points of view, and to point out the course that agriculture must follow in the future in order to attain greater success from the application of phenology.

If we survey the province of phenology in agriculture, it is clear from what has already been said that it is the race, or variety, that must be taken as the lowest unit for practical work. Upon it alone depends agricultural success. Phenology has an important rôle as the science destined to play an auxiliary part in founding a scientific knowledge of variety.

Its task is to help to determine, from specific differences in growth and other characters, whether certain varieties of cereals, fruit-trees, vines, vegetables and forage plants are suited for cultivation in given districts.

The more widely and generally artificially-bred varieties are cultivated in districts where the growth-rhythm and the development-rhythm are different from those found in the plants country of origin, the more indispensable becomes the knowledge of agricul-

tural phenology if it is desired to obtain any special performance on the part of the variety, and especially if the object is to produce heavy crops under determined climatic conditions.

We may look forward to the possibility of this aim being realised by means of the growing intercommunication between State and State.

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THE SUBDIVISION OF INDIVIDUALS IN GENETIC RESEARCH (1)

The subdivision of individuals has always been strongly recommended and is now more, or less, widely and successfully practised with the object of improving the quality of the seed that can be obtained from a given specimen ; further, it may also be of valuable assistance in the study of questions of heredity upon which even today the genetists do not agree. It also affords a good means of determining to what extent an individual is capable of being affected by, and of reacting upon, distant environmental factors and thus renders possible the estimation of the importance and effect of these external conditions.

It is now time to ask how it happens that a method which has been adopted with signal success in the past by certain investigators in special isolated cases (for instance by G. Bonnier in his work on *Taraxacum officinale*), has not been employed as the usual means of dealing with much more complicated problems.

Certainly, it is not always sufficient to give a proof in any given case ; frequently a counterproof is also required, and since this counterproof to be of any real value must be obtained by an experiment on the same individual used for the first test, it can well be understood that the previous division of the individuals is an assistance to the investigator in his delicate task and provides him with the means of controlling the data obtained.

We have had recourse to this method especially in the study of problems connected with the auto-sterility of types and the debility caused by inbreeding, but the cases in which it can be adopted advantageously are without limit.

Comment will be confined to a few of the most typical cases.

Autosterility. — This is one of the subjects most under discussion, not only on account of its importance, but also because of the extreme delicacy of the investigations entailed.

(1) The term "individual" is taken in its most ordinary sense and not in a literal or etymological sense.

We shall only consider the question of *Beta vulgaris* which was regarded by Ch. Darwin as being one of the many self-fertile species (see bibliography, 1876, p. 367) but which H. B. Shaw (1916) and E. Jensen (1922) declare to be almost self-sterile, although J. de Vilmorin (1923) holds Darwin's opinion and regards this plant as self-fertile to a certain extent, if not to a high degree. Our conclusions are in accordance with those of J. de Vilmorin.

The dissimilar and almost opposite behaviour of the type as shown by the results recorded by the several investigators might perhaps be naturally explained as the different and distinct response to different conditions of habitat. This hypothesis was actually brought forward by Ch. Darwin as early as 1876 (l. c. pp. 331-335), and subsequently maintained by A. B. Stout (1922 and 1923), as well as by other authors. There is also a further question viz., to what extent are self-sterility and self-fertility respectively connected with individual factors? That such a connection exists in certain species has been clearly demonstrated by A. B. Stout (1917 and 1918) in the case of *Cichorium Intybus*, and by B. Kajanus (1917) and J. de Vilmorin (l. c. pp. 81-82), in that of the beet.

It would, however, be interesting and most advisable to make further researches in ecologically distinct districts using the same material and method; possibly biotypes of recessive character could be employed, and the method of subdividing individuals adopted.

Debility caused by direct fertilisation. — Another question no less important than the above, especially from the practical standpoint, is the weakening, or loss of vigour, induced by self-fertilisation. It is well-known that the hypotheses put forward to explain the signs of debility due to inbreeding which make their appearance at once in the first generation, are not accepted by all genetists. We should do well to recall to mind the acute critical remark of E. Baur respecting the decreased vigour *in all* the direct progeny of a self-pollinated maize plant. Why among the descendants of an entirely hybrid plant, viz., one belonging to a species normally cross-fertilised, should we not find homozygous and also heterozygous individuals, and in this case why should debility, or degeneration, suddenly appear in *all the offspring* of the self-pollinated parent? (1).

(1) In the 1919 edition, the author makes substantially the same remark although in other words (1919, p. 331).

We are of opinion that much light could be thrown on this difficult question by means of a series of researches in which each case is supported by a counterproof.

VARIOUS PROBLEMS. — By this means, it would be possible amongst other things, to better explain the phenomena of adaptation, acclimatisation and the so-called change of seedlings and to determine the extent of the degeneration produced in fixed hybrids as a result of change in environment. In addition, it would be possible to set and solve more quickly problems of crossing and of all other kinds where the results are easily altered or, falsified, by individual factors, for in such cases, it is indispensable to obtain from a given individual in the shortest time, seeds to be sown at the same date in places differing in environmental conditions, or else to divide the individual, in order to grow the fragments in totally distinct habitats.

TECHNIQUE EMPLOYED IN SUBDIVIDING PLANTS AND THE MEANS OF CARRYING OUT THE EXPERIMENTS. — Of the various commonly-grown species of plant, wheat, barley and rye are well-kown to lend themselves most easily to subdivision owing to their free tillering. We usually obtain our material by sowing the cereals in the summer and by this means, obtain seeds harvested the same year and hence incapable of germinating at 25°-30° C. The temperature of the seed-bed is artificially lowered to 12°-15° C. which permits of a large percentage of the seeds germinating on the fourth or fifth day (observations made by G. HARRINGTON in 1919 and by us in 1920).

Early in October, the first subdivision can already be made, while in the spring, each fragment can be divided again. In this way, as many as 30 tufts can easily be obtained from the one seed. These fragments are some of them potted (for taking to a distance), while the others are planted out ; eight to ten tufts are more than sufficient for most of our experiments.

There is an exhaustive literature dealing with the subdivision of the sugar-beet which is an equally easy operation. For the special purposes of our investigations (leaving out of account the selection question properly so-called) 6-8 fragments are enough (see Table III, fig. 1). The same may be said in the case of chicory (see Table IV, fig. 4) (1).

More elaborate technique and special care are required in the case of carrots (see Table IV, fig. 3), mangels (see Table III, fig. 2) and garden beets. If the plants are subdivided young, it is always

(1) Under the conditions found in the Bassa Valle Padana, the operation of subdivision and other so-called asexual methods of propagation are very difficult in the case of beet plants at the beginning of the second year of their growth cycle.

PLATE III.

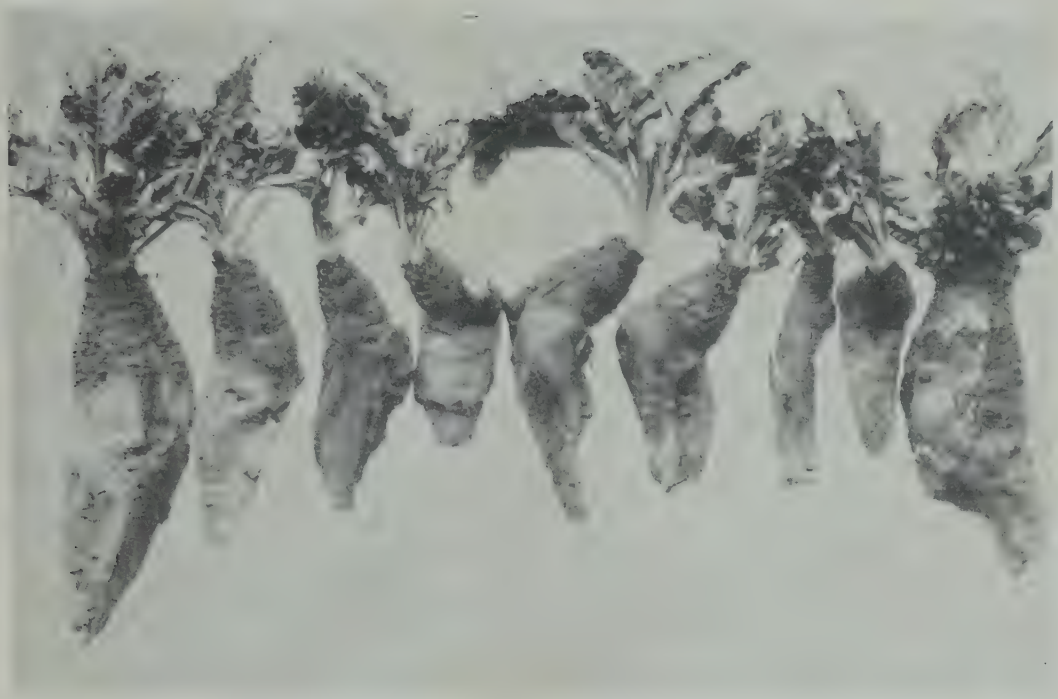

FIG. 1. — Sugar Beet at the end of the first year
(spring sown; cut into fragments in May-June; photographed November).

FIG. 2. — Yellow Eckendörfer Beets.
(Spring sown; cut into fragments end of May; photographed November).

PLATE IV.

FIG. 1. — From four fragments of one carrot [photographed in November]

FIG. 2. — [From four fragments of one carrot photographed in November]

FIG. 5. — Lateral shoots from a single plant of maize cut from main stem grown under different conditions.

FIG. 6. — Group of tillerings from a single plant of maize cut from main stem The left, self-pollinated; the right, cross-pollinated

possible to obtain at least four fragments which grow so well that they almost invariable assume the morphological character of the type.

If maize is subdivided at the right time, certainly two vigorous lateral shoots can be cut off from the main stem ; these can be planted either in pots, or in the open (see Table V). Since most frequently the side shoots (or suckers) of maize bear normal ears, it is well to start with numerous plants and choose those best suited to the special purposes.

As regards material upon which our work was based, we have recently published a paper (1923) giving some observations made in 1922 on rye (*Secale cereale* L.). With the object of obtaining some idea of the possible limits of self-fertilisation in the species under the conditions prevailing in the Lower Paduan Valley, we decided to use as an indicator a rye which had been kindly sent to us by H. HERIBERT NILSSON (1917). This seed was sown in the summer of 1921, and as a result of repeated subdivision, we had at our disposal in the spring a large number of tufts from several individuals which permitted of the most varied combinations. Supposing we have three individuals A, B, C, it is possible to group together, for separate fertilisation, tufts of A, of B by B, C by C, A by B, A by C, B by C, and if the number of individuals were larger, it would be possible to form combinations in series, or in a chain. If the fragments are planted out in different plots in enclosed gardens, and cultivated differently, it is clearly seen on examination after they are harvested that : 1) according to the district, or the season, the type is almost self-sterile, ears almost without grain in combinations of stools from the same individual ; 2) in no individual examined was there any conspicuous tendency to self-fertility.

By adopting the method we suggest it is therefore not only possible in each given case to conclude the research without any uncertainties and doubts (such as frequently assailed the investigator in the field of genetics when the experiment had the inherent defect of the lack of a control test), but it is often feasible to face and solve problems with a relatively small number of individuals. In this manner, reliable and certain results can be obtained with the least expenditure. With due precautions, students of the problems of heredity could also exchange their material and thus we should be able to throw light upon the still inexplicable sides of ecological complex.

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COTTON IN COLOMBIA

The geographical position of Colombia makes the country an ideal export and distributing centre of raw materials and manufactured products. Furthermore, its wonderful topography gives the country the advantage of successfully growing all varieties of products. Cotton cultivation is one of the most promising industries of Colombia, and its development may be of great importance to the textile industry of the world. The country possesses immense territories suitable for its cultivation but very little effort has been made to exploit this source of riches.

The establishment of a few weaving factories has given some importance to the industry lately, but, as the consumption of these factories is limited, the cultivation of cotton has not received the impulse it deserves. Coffee being the principal industry, every planter gives his attention to the cultivation of this plant and consequently the development of other agricultural crops is very slow.

The country offers excellent prospects for cotton, and foreign capitalists will find a good investment for their money in this industry particularly now, when there is such a shortage of cotton throughout the world. Until to-day cotton in Colombia has been grown only by small planters, on a very reduced scale. No capital at all has been invested for cotton cultivation purposes. Labour is cheap in the country and large tracts of Government land are available; the average wage is 1 *peso* per day.

Zones. — Colombia has an area of 462,000 square miles and possesses a temperature varying from 20°F. in the Andes to 100°F. at the Coast. Generally cotton grows in regions where the temperature is above 77°F., in some places as a native plant and in others under primitive cultivation.

The first zone for cotton cultivation is on the Atlantic Coast, where it has been given special attention. The lands beyond the rivers Magdalena, Sinu and San Jorge offer the most suitable conditions for the development of the plant.

The temperature for a considerable distance inland varies between 90° and 100°F. during the whole of the year. The rainfall is fairly regular and seasonal, and records are available for the last 17 years. The soil, in all respects, is suitable for cotton growing and large tracts of land capable of cultivation are available. Labour is cheap and facilities for transport along the Madgalena and tributary rivers are constantly improving, and therefore, transport problems offer no difficulties in this part of the country.

Seventy five per cent. of Colombia's cotton is grown on the Atlantic Coast. The whole of this district including the Departments of Atlantico, Magdalena and a portion of Bolivar, lies between the ninth and tenth degrees North Latitude, and both for soil and climatic conditions is admirably suited for the cultivation of long staple cotton.

The *second zone* is on the Atlantic Coast and lies on the Goajira, where is produced the best type of cotton, both for staple and grade, the bolls being delivered to the ginner absolutely free from trash, ginning well and supplying a more regular staple.

Third zone. — The third zone for future cotton cultivation includes the lands between Puerto Berrio and Neiva, along the Magdalena Valley, where cotton is grown at present on a very reduced scale. This tract of country includes the Departments of Antioquia, Santander, Tolima, Huila, and a portion of Boyaca and Cundinamarca. In this part the temperature of 70 to 90 degrees F. is about the same throughout the year, with little variation, and the rainfall is favorable. All the cotton from this territory has the same characteristics and varies but slightly, due to the natural conditions, and such growth is characteristic of Colombian cotton. The kind of cotton called Antioquian is said to be well grown and picked, but the staple is harsher and not quite so regular as that from other sources.

Fourth zone. — The fourth zone covers Santander, Boyaca and Cundinamarca Departments, where cotton grows already in several districts, especially along the Suarez, Chicamocha, Upia, Legupa and other rivers. The East Llanos or plains (Casanare and San Martin), offer also suitable areas, where one of the best types of indigenous cotton is found. A sample of this cotton was sent to the Imperial Institute and the analysis results were quite satisfactory, as explained later on.

The *fifth zone* occurs along the Cauca and Patia valleys and in

other districts of the Valle, Cauca and Marino Departments on the Pacific Coast. The Cauca Valley offers very attractive conditions and should prove a remunerative investment in such parts of the Valley where the soil is well drained and free from floods.

Characteristics of Colombian cotton. — The plant is perennial and will grow for an indefinite number of years, subject to diseases and old age. This is attributable to two causes, its natural characteristics and to the absence of frost in the country. In the first year of its growth the plant is similar to the American variety in respect to its main stem and branches and attains a height of about four or five feet. If left to nature the leaves fall annually, due to the dryness of the season; the branches remain and sprout again in the following rainy season. In succeeding years the plant forms a dense bush, increasing in height and in girth, but never forming a tree in so far as the main stem does not materially thicken annually, the height may reach fifteen feet and the bush attains a diameter of two to three yards. Under cultivation the plant is cut down after the picking season to within nine or twelve inches of the ground, and although during succeeding years the bush will increase in height and in girth, these will seldom exceed ten feet and four feet respectively.

Almost every sample of Colombian cotton will contain a small percentage of cotton of a chocolate brown shade. In ginned samples the tinge is lost in the greater bulk of the usual cream shade; in seed cotton the bolls of brown cotton are very noticeable and will vary in quantity in each lot.

The staple. — As in all growths of cotton, the length of staple varies according to the season and the local conditions during the growing period. The longest staples of Colombian cotton will pull one and one quarter, to one and five-sixteenth inches, and the lowest sample will not come short of one and one-sixteenth to one and one-eighth inches. It is slightly harsh to the touch, but not so much so as rough Peruvian, and the drier the season of growth the harsher it feels. The feel of the cotton from different districts will also vary slightly, thus: the Goajira cotton pulls and feels more like Sea Island cotton; it is clean, creamy, soft and lustrous; next to this is the staple grown on the delta at the mouth of the Madgalena, especially in the vicinity of Remolino; this is shorter in staple (one and three-sixteenth to one and one-fourth inches) and somewhat harsher, but it is a good and regular cotton. The Antioquian cotton bears much

resemblance to this. The worst quality cotton is grown on the west bank of the Magdalena. Here the soil is calcareous and sandy and of volcanic origin in great part. The ground is higher and not subject to the river's influence, as on the east bank of the river. The soil is not so fertile and it is not uncommon to see fields deserted after two years' cotton growing, with old cotton standing uncultivated and running to decay, while fresh ground in the neighbourhood has been cleared for new crops.

Spinning Qualities. — Colombian cotton is easy to spin, produces a much stronger yarn than Upland American cotton, and if picked clean the waste in opening and carding is less than usual in spinning middling (one inch staple) American. Colombian cotton is fine and long and is a superior fibre for spinning. The only fault from the spinners' point of view is the amount of trash that the majority of native cotton has hitherto contained.

Varieties of Colombian Cotton. — The plant producing cotton, like all the vegetable species cultivated by man, has multiplied in types and varieties more or less selected and removed from the original.

The variety « Pajarito », which grows throughout the country and is indigenous, has generally the same physical characteristics but nevertheless, in some regions is not perennial and its development is less exhuberant than in others. It is the only type of short fibre in Colombia and grows spontaneously in all the warm zones, producing abundant crops almost permanently, since it flowers continuously ; along with other wild plants it has great resistance and stands the heat as well as diseases and the attacks of insects. Its fibre is smooth and brilliant, of a white colour and is generally well accepted in the spinning factories.

" Common " Cotton is a variety of long fibre cultivated in various parts of the country specially in Santander, Boyaca and Antioquia, where the production reaches satisfactory figures. It is certainly the *Gossypium herbaceum* known extensively throughout America and is the original source of the local varieties.

" Creole " Cotton is cultivated in the colder climates and presents the caracteristics of the above variety but a little degenerated by the influence of the climate. The production is very limited at present.

" Kidney " Cotton. A very vigorous plant with luxurious foliage, flowers early and resists drought and pests. Nevertheless the pro-

duction is limited and up to the present it has not been specially cultivated, notwithstanding the advantages which could be obtained by a careful selection of seed. The seed has the peculiarity of being firmly stuck together forming a compact nucleus of 8 or 10 kernels. This disposition of the seed greatly simplifies the work of separation of the lint, and in large plantations of kidney cotton, it would be possible to use simpler methods for removing the fibre.

" Boyaca " or " Legupa " Cotton. This type is doubtless the best grown in Colombia. The fibre has an average length of 1.1 inch and the production of each plant is so abundant that during the crop the fields appear to be covered with snow. The Legupa cotton also grows well in the south of Santander and is used by the factories of Suaita and Samaca.

This cotton constitutes a select variety, and samples sent to Manchester attracted the attention of dry goods manufacturers who considered it the best raw product for the manufacture of lace.

The following is an analysis by the Imperial Institute:

Number of mark and weight of sample: " Boyaca seed cotton (white) " weight 2 oz.

Description: Unginned cotton.

Lint: Moderately harsh, lustrous, clean, and varying from cream to pale brown in colour. The lint yield on ginning was 45 per cent.

Seed: Brown seeds, covered, with pale brown fuzz.

Strength: Very good.

Length of fibres: From 0.7 to 1.4 inch.; mostly from 1.0 to 1.2 with an average of 1.1 inch.

Commercial valuation: The cotton was valued in Liverpool at nominally 50*d* per lb., with " middling " American (June " Futures ") at 24.64*d* per lb.

Remarks: This cotton was of excellent strength and good quality and would be readily saleable in this country.

" Caqueta " Cotton. At the National Agricultural Exhibition in 1916 several cotton wools grown in the Caqueta region and considered as a special botanical variety were shown. The fibre shows no difference from the ordinary cotton, it being presumed to be the same *Gossypium herbaceum* above noted.

" Simacota " Cotton. A variety cultivated in the Municipality of Simacota in Santander del Sur, which is appreciated as much for the quality of its fibre as for its resistence to drought. Very similar to the " Durango " of Mexico, this variety presents features which distinguish it from those previously mentioned. The plant attains a height of 6 feet, its shoots when deprived of floss are of a clear red colour and are more flexible than the ordinary cotton. The foliage is very abundant and appears early, the capsule is long and

narrow, and on opening allows the wool to escape slowly so that the strong winds do not injure it, as is generally the case with other varieties. Usually there are three lobes or divisions to the boll, and sometimes four lobes are found. The seeds are black, acutely pointed, bald and smooth. The cotton of Simacota forms a special variety.

"Mono" Cotton. Is borne on distinct plants that have every caracteristic of the cream variety, except the colour of the staple which is pale brown or khaki. The length of the staple is also slightly under that of the usual cotton grown under the same conditions. The plant has a distinct origin and holds to the parent type.

The trials of introduction of exotic cottons (Peruvian, Sakellaridis, Mitafifi, Novary, Caravonica), have not given satisfactory results; all of them have sooner or later degenerated.

Cotton diseases and pests. — As in other cotton producing countries this plant is subject in Colombia to the destruction caused by diseases and pests. The most dangerous is an insect which as a worm attacks the young cotton plants and also the leaves in the old ones. In some places it is possible to find also the *Heliothis varia* which attacks the flower. But these two insects are not very widely spread over the country and the crops have never suffered greatly from this cause. Another insect has been noticed in the Goajira zone, known as the White Scale, *Hemichionaspis minor*, a destructive pest against which much effort has been directed with the view to its eradication.

A disease known as "Fucha" appears on the leaves in the form of small protuberances and within a short time the plant attacked becomes yellow and dies. This disease has been observed in the cotton plantations of Boyaca, and seems to have its origin in the condition of the soil, which is unable to supply the plant with the necessary mineral substances.

Cotton cultivation. — The cotton growers in Colombia do not take much care about the preliminary work and are content with just a light cleaning of the land before sowing. Planting takes place during the first few days of the rainfall months, usually about April, and the plant grows and reaches its normal size with very little attention, until the gathering of the crop, 10 months later. Though it is much better to replant the cotton after the crop is collected, in which case the old plants should be rooted up and burnt, the growers in Colombia prefer to keep up the same plantation for several consecutive years.

After the crop is collected the unginned cotton is taken to the nearest markets where it is sold for domestic uses or to the buyers for factories. Until a few years ago the cotton seed was used only for sowing but now it is exported for oil extraction.

The average yield of cotton per hectare in 750 kilos.

It is generally estimated that a pound of cleaned cotton is obtained from each seven trees, hence, the total production from a hectare (10,000 trees) will be 1428 lbs. It is evident that this estimate may vary considerably according to localities and circumstances.

In 1915 the crops were estimated at 7,596,605 lbs. and the areas under cultivation at 11,240 acres. The crops during that year were comparatively small. During the last year the area under cultivation has more than doubled, the demand having increased rapidly with the erection of new factories. To-day the production may be estimated as well over 16,000,000 lbs.

Colombia does not export cotton and large quantities have to be imported, the entire production being used by the factories and domestic industries.

At present there are several cotton mills in the country, some of them as good as the Manchester mills, with machinery imported from Lancashire. The number of looms in operation to day is approximately 1,600 with an average production of about 36,000 yards daily. The principal factories are in Barranquilla, Medellin, Bogota, Suaita, Samaca, and new ones are projected in other towns.

There is no tax in force at present on cotton exportation in Colombia.

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STOCK-BREEDING IN MOROCCO

Stock-breeding is a very important industry in Morocco as is shown by the figures referring to the three species of animal chiefly reared there. The number of cattle in the country may be estimated at 1 800 000 head, while there are nearly 7 000 000 sheep and over 2 000 000 goats.

All the districts of Morocco are suited to stock-raising, but the best cattle are bred in Zaer, and Zemmour, Gharb, Doukkala and Abda. On the other hand, Oued Zem and El Boroudja, Camp Christian, Beni-Ahsen and Berguent are the centres supplying the finest sheep. Good sheep are also to be found at Guercif in the Taza region and at Ben Guerir in the district of Marrakech.

Cattle. — The native cattle of Morocco belong zoologically to two principal types. The first of these includes $^4/_5$ of the total number; the animals are brown and brachycephalic. The adult bulls weigh on an average 250 kg. The cattle belonging to the second type are larger, light-coloured, dolichocephalic animals; the average weight of an adult bull is 300 kg.

The cows of both types are poor milkers and will only yield their milk in the presence of their calves.

The breeds of cattle in Morocco are very hardy and are very little affected by the scanty food they obtain during the drought of the hot season.

These breeds are improved by the natives by means of selection and by mating Moroccan cows with Zebu bulls imported from India, or with the half-blood or quarter-blood products of such crosses. So far, the results of selection are not particularly noticeable. The zebu blood would prove more effective if a larger number of bulls were imported, for it is a fact that the hybrids gain in early maturity and working qualities without losing their excellence as beef cattle. It must, however, be allowed that these animals are sometimes rather savage and need careful handling.

The European breeders are at present engaged in crossing ex-

periments with bulls imported from France and belonging principally to the Montbeliard and the Gascon breeds.

Montbeliard and Breton dairy cows are imported every year and contribute to a large extent in supplying the milk required for consumption in the towns of Casablanca and Rabat. If these animals are kept under hygienic conditions and not allowed to come in contact with the native cattle that are infested with ticks, they give for many years, as much or more milk than they would have yielded in their own country.

The Municipal dairy of Casablanca has fifty cows of the Montbeliard breed, or Jurassic type, which have produced an annual average of 3 500 litres of milk during the last three years. The animals are stall-fed and receive a basal ration of barley, bran and oat-straw.

Very fine hybrids have resulted from mating these cows with a zebu bull imported from Ceylon. Four of the bull calves were sold at the age of ten months at a public auction where they were purchased by European breeders at prices ranging from 1 200 to 3 550 francs each.

About 60 000 head of cattle were exported from Morocco in 1922.

The export, or slaughter, of cows less than eight years of age is prohibited.

Bulls of any age whether castrated, or not, may be exported.

Sheep. — In the West of Morocco, three principal types of sheep are found.

The first type is met with in the Tadla district (see Table V, Fig. 1). These animals produce fine wool and their shape renders them satisfactory for the butcher.

The average weight of young rams that have shed two of their milk teeth is 45 kg., ewe lambs of the same age weigh 36 kg. The average weight, of adult rams and ewes is respectively 65 kg. and 43 kg.

Well-fed rams and ewes can turn the scale at 80 and 60 kg., but these exceptional weights are not reached by the largest, but by the best-shaped animals.

The Tadla sheep fattens quickly in the spring, but loses flesh rapidly as soon as the period of summer scarcity arrives.

Its face is white, or yellow ; sometimes in the variety known as " Sourdia " it is black and white. The fleece is usually white and extends down to the hoofs of the kind-legs ; the forehead is broad,

the skin often being wrinkled as in the case of the Merino. The horns are strong, well-developed, directed backwards at the base and forming a spiral round the semi-drooping ears.

The wool is not always of a uniform quality. The best product is known under the name of " Urdighia ", called after a tribe inhabiting that region ; it is soft, resistant and of medium fineness corresponding to Nos. II and III of the wools from cross-bred sheep, type Roubaix-Tourcoing. The fleece is dense and even in quality, but often contains a certain amount of yolk in the lower portions.

When the wool is fine, it is usually short, so that the fleece only weighs 1.20 kg. to 1.50 kg. The inferior fleeces, known as " Beldia " weigh from 1.80 kg. to 2 kg. in the case of average-sized animals in good health. The difference in the price of fleeces of various qualities is at present negligible, the heaviest fleece fetches the most money.

Since the finest wool comes from the more delicate sheep, it is easily understood that the natives have taken no special pains to obtain fleeces of this quality.

A second well-marked type is that kept by the Beni Ahsen, a tribe dwelling near the coast and south of Oued Sebow. The rams have a very much developed dewlap, transverse folds of skin on the forehead and a long soft fleece (see Table V, Fig. 2).

The wool is long and fine, but somewhat deficient in strength. The average weight of the fleeces is 1.500 kg. to 2 kg. and the yield 42 to 46 % when they are thoroughly washed. The quality is that known as " Aboudia ", which is remarkably white after washing. Its fineness corresponds to that of Nos. I and II of the hybrid wools of Roubaix-Tourcoing type.

From the butcher's point of view, the conformation of the Beni-Ahsen sheep leaves much to be desired. The back is too narrow, the leg is flat and the hind-quarters are narrow.

The third type, the Berber sheep of South Morocco, is hardier and more widely kept, and is smaller than the two preceding types. The average weight of this animal is from 15 to 25 kg., its conformation is good, the barrel round, the leg fairly well-shaped and the neck short. The horns resemble those of the merino, but the fleece is not very long, is of inferior quality and often black. The wool is known commercially under the name of " Beldia ".

In East Morocco the Berguent sheep is found which greatly resembles the Algerian sheeps (see Table VI, Fig. 3). It lives on

FIG. 1. — Tadla sheep.

FIG. 2. — Gharb sheep with dewlap.
(Size 80.60 kg. white red head).

FIG. 3. — Berguent sheep.
(Two milk teeth shed — height to withers 71 cm ; weight 51 kg.)

the high plateaux. The mutton from the young castrated animals is good and the wool is of average quality.

The native flocks are improved by mating the ewes with a Tadla ram and by crossing the Moroccan sheep with merino rams imported from Crau. As the Tadla breed matures late, the rams must not be used for breeding purposes before they are two years old.

Where the colonist is careful, prudent and competent and is able to adopt hygienic measures and feed his flock in the way required by systematic breeding, there is no doubt that in certain parts of Morocco which are very different from Algeria and Tunisia, it is worth while using a superior type of animal rather than the Crau merinoes for improving the stock. The Crau sheep is a semi-travelling animal, and the idea of stabulation as practised in most of the country districts of France, is gaining ground every day among the sheep breeders of Morocco, for no other system allows of constant supervision of the flock and of adopting the hygienic measures and the rations that are in accordance with the latest stock-breeding precepts. Private initiative has taken the lead in this direction and excellent results have been obtained by mating Dishley-Merino rams with native selected ewes. The hybrid lambs weigh on an average 45 kg. at the age of five months.

In order to encourage these experiments, the " Direction Générale de l'Agriculture, du Commerce et de Colonisation " pays the custom-dues and part of the transport cost of all imported breeding rams regarded by the Stock-Breeding Service as capable of improving the local races. Similar measures have also been taken in reference to other kinds of animals.

The Stock-Breeding Service imports annually from Crau, Merino rams and ewes which are generally intended to be dispatched to the Experiment Farms of the Protectorate. In the course of 1923, the above Service sold eight months' old ram and ewe lambs, that were the offspring of these sheep imported from Crau.

Rams of any age, and ewes more than five years old may be freely exported from Morocco by way of the ports, or the frontier stations including those of the Algerian-Moroccan frontier. Ewe-lambs of less than five years of age can only be exported from the Algerian frontier; the period of exportation is limited, and extends from January 1 to June 30 of every year.

Throughout the whole French zone of the Sherifian Empire, the slaughter of ewes until they are five years old is prohibited.

During 1922, 35 000 sheep were exported from Morocco by way of the ports or frontier stations. The number of those that crossed the Algerian-Moroccan frontier may be reckoned approximately at 120 000.

Swine. — The systematic breeding of swine is in course of development in Morocco, and though it is practised almost exclusively by Europeans, the natives are beginning to understand its economic importance.

So far, no local breed exists and the herds are composed to a great extent of pigs belonging to the Iberian type with black or grey coat, erect ears and an average weight of 70 to 90 kg. at the age of one year. Some herds of improved swine have already been formed by crossing sows bred in Morocco with imported Crau, Yorkshire and Cazer boars.

Generally speaking, the pigs are reared in a half-domesticated condition being turned out into the fields every day as soon as they are weaned. When they return to the sty, they are fed barley, maize, or beans.

An animal weighing 80 kg. can increase its weight to 130 kg. if fattened for three months in the sty. The experiment farms sell young cross-bred Yorkshire boars and sows for breeding purposes at the beginning of each year.

About 60 000 pigs were exported from Morocco in 1922.

Goats. — The Moroccan goat weighs on an average 30 kg.; it has a rectilinear forehead, long hair and generally a black coat; the horns are flattened and directed backwards; the ears are rather long and drooping. It is a fair milker, and the flesh is appreciated by the natives who eat nearly as much goats' meat as they do mutton. When mixed with camels' hair, the hair of this goat is used in the manufacture of ropes and a woven fabric employed for tents. The skins of the Moroccan goats are very resistant and have therefore acquired a world-wide reputation. Over 1 500 000 of these salted dried skins are exported annually; the average weight of each is 1 kg.

Horses. — The great majority of the horses met with in Morocco belong to the Barbary breed. The Moroccan horse resembles the Algerian Barbary, but is thicker set than the latter; it does not possess either the blood or the distinction of the Arab.

Great improvements have been obtained by the Stud Station Service which possesses 300 stallions of good breeds that have been imported from Algeria, France and Syria.

These stallions are distributed every spring among a certain number of Service Stations built and kept up by the " Direction Générale d'Agriculture ".

POULTRY. — The Moroccan hen is a small bird, but a good layer, therefore eggs form an important item of export, the average value of those sent out of the country annually being 40 million francs. These eggs only weigh 48 gm. on an average ; they are shipped in crates containing 120 dozen from the ports of Mazagan and Casablanca.

The Stock-Breeding Service imports poultry of good strains for breeding purposes. The best results have been obtained by crossing the Faverolle and the Spanish breeds.

As a rule, the domestic animals of Morocco are very hardy and suffer less from epizootic diseases than the live-stock of other countries.

There is, however, one disease of a parasitic character that does great havoc among the sheep and that is strongylosis. This disease which is due to a parasitic worm, is controlled by attention to the watering-places and by transforming the mud-holes frequented by the animals into hygienic drinking troughs.

Piroplasmosis, a disease that must be reckoned with in the case of all imported breeding cattle, is not so common, or so serious in Morocco as in the other countries of North Africa.

Bacterial diseases that might become formidable if they assumed an epizootic form, play but a very small part in reducing the number of the live-stock in Morocco.

The organisation of a Veterinary Service which enables the source of such epizootic diseases being traced, and the institution of a well-equipped veterinary bacterial laboratory at Casablanca afford the best possible guarantee against these scourges.

Communication from the Stock Breeding Service of the Department of Agriculture.

AGRICULTURAL INTELLIGENCE

AGRONOMY.

Agricultural Meteorology.

1. **The Yield of Swedish Clover and of Red Silesian Clover at Svalöf as Affected by Rainfall during the Period 1908-1911.**

Rotklöfvarns af Kasting på Svalöf under åren 1908-1921 och nederbördens inverkan på skörderesultatet under olika år. *Sveriges Utsädesförening Tidskrift*, Year XXXIII, Part. 3, pp. 169-182. Svalöf, 1923.

From cultural experiments made at Svalöf from 1908-1921 on Swedish clover and Silesian red clover, it appears that the first year Swedish clover yields a crop 8 % larger than Silesian clover, the usual average being respectively 7930 kg. and 7300 kg. In the second year, the superiority of the Swedish clover shows itself most distinctly, for it produces a crop twice as large as Silesian clover, the respective figures being 5790 and 2590 kg. Further, even the first year, Swedish clover is also more satisfactory than the Silesian, if we consider the two cuts separately estimating them in percentages of the total yield. The first crop, which is properly speaking the hay crop, is 85 % of the total yield in the case of Swedish clover, and only 60 % in that of Silesian clover.

Atmospheric disturbances exercise a great influence on the growth of clover, the rainfall being the chief factor causing variations in the crop. From phenological data it is seen that, on an average, Swedish clover is ready for cutting 17 days earlier than Silesian clover, thus using less water though producing a heavier yield.

The 14 years' average maximum and minimum rainfall from April 1st to the harvest was 140 and 105 mm. respectively. In the case of the Swedish clover, the maximum precipitation occurred in 1908 and 1920 (254.6 and 228.4 m.) the maximum crops being obtained in these two years (11,470 and 10,200 kg. respectively). The Silesian clover received most rain in 1920, 1916, and 1918, the rain-gauge registering 221.3, 190.6 and 178.0 mm. These wet years also produced the heaviest crops, 6930, 6000 and 9710 kg. respectively per hectare.

The minimum rainfalls experienced by the Swedish clover were in 1917, and 1914 (49.6 and 52.0 mm.) and the crops were correspondingly lighter falling to 2980 and 2240 kg. of hay per hectare.

The Silesian clover suffered from the drought of 1921, 1917, 1914 and 1915 (31.3, 37.8, 47.0 and 50.3 mm.) and the crops were small: 2730, 2190, 1330, and 2290 kg. per hectare.

The environmental factors exerted less effect on the second cuts, for other influences besides rainfall came into play. The aftermath of Swedish clover depends much upon the time when the first crop is cut.

If the field is mown before the plant flowers, the aftermath is large, provided sufficient rain falls in the interval between the cuts, but if the field is cut late after the flowering is over, the second crop is poor however much rain falls.

The author shows the relation of the aftermath crop to the total rainfall from the tenth day before the first cutting, to the tenth day before the second cutting (in years when the first crop was cut at the right time viz., not too late).

TABLE I. — *Rainfall and yield of second cut, Swedish Clover.*

Year	Rainfall mm.	Hay from second cut kg. per hectare
1910	229.3	2.420
1911	82.9	320
1913	132.4	2.280
1914	85.6	320
1917	87.0	1.060
1919	149.4	1.900
1920	134.3	2 120
1921	230.0	1 940

The connection between the second crop and the rainfall during the same period is more marked in the case of the Silesian clover (Table II), for as it ripens earlier, it can use a greater amount of water.

TABLE II. — *Rainfall and yield of second cut, Silesian Clover.*

Year	Rainfall mm.	kg. per hectare
1910	270.0	4 980
1911	99.8	1 760
1912	116.4	2 430
1913	127.3	3 140
1914	71.0	780
1916	195.3	3 230
1917	70.9	1 120
1919	198.5	3 180
1920	153.5	5 300
1921	274.7	3 400

G. A.

2. Critical Periods in the Growth of Sugar Cane.

KOENIG M. (*Bulletin No. 27*. General Series Department of Agriculture. Mauritius. Port-Louis, 1923). *International Sugar Journal*, Vol XXV, No. 30, p. 643-644. Manchester, December, 1923.

The object of the author's investigations was to ascertain whether there are any distinct periods during the growing season of the sugar cane when rainfall and temperature are of special influence on the ultimate crop yield.

From data collected over a series of years at 27 stations on the island the following conclusions have been reached :

a) There are, in the growth of the sugar crop in Mauritius, several critical periods, during which the action of certain meteorological factors exercise a permanent effect.

b) There are two periods for rainfall, viz., November-December and June-July. At other stages of growth of the cane the effect of the rain can be compensated, but, during these critical periods, abundance or deficiency of rainfall produces a permanent effect on the crop.

c) High temperatures are important at all times, but chiefly during the month of March, which month is critical as regards temperature.

The author considers that when more data are available it will be possible to select those varieties best adapted to given climatic conditions. W. S. G.

3. The Use of Artificial Smoke Clouds in Combating White Frosts.

CHASSANT, M. and CLARTE, R. Une expérience sur la lutte contre le gelées blanches par les nuages artificiels. *Annales de la Science agronomique*, Year 40, No. 2, pp. 88-91. Paris, 1923.

On the occasion of the severe cold of April 20, 1922, some experiments were carried out at Montpellier, artificial smoke-clouds being used to combat the frosts which were doing much injury to vegetation in general, and especially to the vineyards.

For the production of the smoke, some "engins fumigènes Berger" (Berger smoke-generators) left over from the war were employed. These generators produce a dense, heavy smoke of metallic oxides.

The spot chosen for the tests was very suitable, being a small valley 1 kg. in length and 500 m. wide; it was entirely surrounded by hills so that the cold air accumulated there during the night.

At 2 o'clock on the morning of April 20th, when the thermometer had already fallen to +0.2°C., the fires were lighted and all the bottom of the valley was soon filled with a dense stratum of smoke that prevented the cold masses of air from descending and also reduced the loss of heat by radiation from the ground. Throughout the whole area covered by the smoke there were no cases of injury, whereas in the zones immediately bordering on it, half the young buds were destroyed by the frost.

Twelve smoke-generators were used.

G. A.

Soil Science.

4. The Determination of the Specific Surface of Soil.

ZUNKER, F. Die Bestimmung des spezifischen Oberfläche des Bodens. *Landwirtschaftliche Jahrbücher*, Vol. 58, No. 2, pp. 159-203, figs. 10. Berlin, 1923.

The specific surface of a substance is the measure of its degree of dispersion. The permeability of the soil is a function of its specific surface, and upon the latter also depends the depth at which drainage pipes should be laid.

The specific surface is expressed by the author as follows:

$$M = \frac{s}{60} \quad O = \frac{1}{dw}$$

S here represents the specific gravity of the soil, O is the sum of the surface of the particles (which are regarded as round), and is expressed in cc. per gm., whereas dw is the actual diameter (in mm.) of the particles. The specific surface is thus inversely proportionate to the average diameter of the particles. The specific surface of any soil is equal to the number by which must be multiplied the surface of an equal amount, by weight, of soil composed of particles 1 mm. in diameter.

In order to determine the specific surface of a soil, it was necessary to employ a method that would include the colloidal substances which are here of great importance. There are several methods from which to choose viz., those of ATTERBERG, SVEN ODEN, WIEGNER, UNGERER and SOKOL. The author selected WIEGNER's method which he improved, making it 10 times more sensitive. The author's mode of calculation also differs from that adopted by WIEGNER. The latter gives a description of his method in the *Landwirtschaftliche Versuchsstationen*, 1918, p. 41.

The author used a glass tube 670 mm. long and 40 mm. in diameter. This tube is connected by lateral openings to an apparatus by means of which the pressure of the column of liquid filling the tube is measured. A homogeneous suspension of the soil sample in distilled water is introduced into the tube. After a certain time, part of the material in suspension will be deposited and the liquid above it will have acquired a different density which can be estimated by means of the apparatus attached to the tube. Several readings are taken each time after a given interval. The author expresses by mathematical formulae the relations existing between the surface of the particles and the rate of their deposition.

As an instance, he describes in detail an experiment carried out with a certain soil and the manner of estimating its specific surface.

The author then expresses by means of a formula the relation existing between the specific surface (U) and the depth in metres at which the drains must be laid down (E).

$$E = 30 - 2\sqrt{u} \quad \text{metres.}$$

In these calculations, both the specific weight of the soil and the hygroscopicity must be taken into account.

The author is of opinion that the means hitherto employed to determine the depth below the soil at which drainage pipes must be laid are wholly inadequate. He criticises the methods adopted by BREITENBACH, CANTZ-FAUSER, COLDING and others.

Practically all that is required is to have one, or two, soil samples per hectare analysed in the manner described by the author. The samples should be taken at the depths of 0.5, 1.0 and 1.5 metre, and analysed separately. The expense of these analyses would come to about 1 % of the total cost of drainage. The author strongly advises drainage specialists to consider these methods of analysis, for the damage caused by a faulty system of draining may be very considerable. D. v. S.

5. Importance of the Osmotic Pressure of the Soil Solution.

TULAIKOV, N. M., (Saratov Agricultural Experiment Station, Russia). The soil solution and its importance in the growth of plants. *Soil Science*, Vol. XV, No. 4, pp. 229-233. Baltimore, Md. 1923.,

The author gives here merely a summary of extensive investigations on osmosis, which will be published later.

Agriculture is always determined in arid regions by that quantity of atmospheric precipitation, which occurs during the period of plant growth and the period of soil preparation previous to the seeding.

A larger or smaller quantity of rainfall increases the quantity of soil moisture and there is a corresponding change in the concentration of the soil solution and its osmotic pressure. Investigations of the importance of osmotic pressure of the soil solution upon the growth and yield of spring wheat were begun by the author in 1910 at the Bezentschuk Experiment Station in the State of Samara, (1) continued in Petrograd 1917-20 and in Saratov since 1921. These investigations are still being continued, not to study the development and yield of wheat, but its chemical composition and protein content. The original experiments on various salts of the same concentration convinced the author that the same concentration of the soil solution produced by various salts, and therefore of different osmotic pressure, does not act alike upon the growth of plants.

In his pot experiments the author increased the osmotic pressure of the soil solution by the addition of common salts: NaCl, Na_2SO_4, $MgCl_2$, $NaNO_3$, $(NH_4)_2SO_4$, NH_4NO_3, etc. in such quantities as to increase, when in water solution, the osmotic pressure by 1, 2, 3 atmospheres etc. Growth, yield, hygroscopic water, total nitrogen and protein and later, the hardness and softness of the grain, when cut, were determined.

As an example, we give here the effect on the average weight of the tops.

(1) See *R.* 1914, No. 987. (*Ed.*).

Average weight of tops per pot in 1914-15.

normal culture	1 atm.	2 atm.	3 atm.	5 atm.	7 atm.
gm.	gm.	gm.	gm.	gm.	gm.
20.2	22.2	22.3	20.5	13.2	1.3

These data definitely establish the fact that, with an increase in osmotic pressure of the soil solution there is an increase in the yield of tops until a certain optimum is reached ; on further increasing the osmotic concentration of the soil solution above certain limits, there is a decrease in yield.

The author gives in other tables, data concerning : the average height of wheat in pots ; the average yield of grain per vessel ; nitrogen content of the grain ; hardness and softness of wheat ; transpiration coefficients.

From numerous experiments with various salts it can be concluded that an increase in osmotic pressure of the soil solution up to a certain limit, will bring about a greater activity of the plants. There will be an increase in size, yield of tops and yield of grain of spring wheat. Further increase in osmotic pressure decreases the yield of tops and grain.

The increased content of nitrogen and protein in the wheat grain of south-eastern Russia and the arid parts of the United States, is doubtlessly connected with the increase in osmotic concentration in the soils, because of the small amount of rainfall in those sections.

The quantity of hard grain is increased with an increase in osmotic pressure, and *vice versa*. This information causes the author to believe that in vegetative experiments the same variety of wheat can be made to produce both hard and soft grain. It was found that nitrates bring about greater increase in hardness than sulphates and that in addition to the influence of the osmotic pressure of the soil solution, one has to note also the nature of its constituent salts.

In the last few years, these investigations have been extended to include other plants. The influence of the osmotic pressure upon the formation of other substances, such as fats, sugars, aromatic bodies, etc. was studied. D. v. S.

6. The Soil Solution.

I. — Burd, J. S. and Martin, J. C. (University of California, Berkeley, California, U. S. A.) Water displacement of soils and the soil solution. *The Journal of Agricultural Science*, Vol. XIII, No. 3, pp. 265-295, 1 fig. Bibl. Cambridge, 1923.

II. — Tulaikoo, N. M., and Kuzmin, M. S. (Saratov Agricultural Experiment Station). On the question of obtaining the soil solution. *Soil Science*, Vol. XV, No. 4, pp. 235-239, fig. 1. Baltimore, 1923.

Numerous studies in the author's laboratory and elsewhere have shown the use of water extractions for many purposes in soil investigations.

But the water extract is imperfectly representative of the conventional soil solution and any method which offers more promise in this respect deserves careful consideration. Among such methods the soil pressure method of MORGAN (*Soil Science*, 3, No. 6, pp. 531-545) and the hydraulic press method of LIPMAN (*University Calif. Publ. Agric. Sci.*, Series 3, No. 7, pp. 131-134) need further study. The author is aware of the theoretical objections to the use of high pressure, as alteration of the soil solution is to be expected from such pressures. A very serious objection to most of the methods employed is the time necessary to obtain solutions from soils containing any considerable amount of colloidal matter.

Equilibrium is probably never attained in moist soils and the solution obtained from soils merely represent average concentrations.

If water is placed on top of and allowed to percolate through a mass of moist soil in a loose state of aggregation, such as that in which it exists in the field under conditions favourable to plant growth, successive portions of the liquid obtained will be decreasingly concentrated until a low and comparatively uniform level is reached. Not one of these proportions can properly be assumed to represent the soil solution and the concentration of the entire solution so obtained will doubtless approximate to that of a water extract obtained with similar proportions of water and soil. If, however, a similar mass of soil is pressed tightly in a container and treated with ethyl alcohol the successive portions of solution have equal concentrations until the displacing agent begins to appear.

In his experiments the author used water as the displacing liquid because of its many and obvious practical advantages. He describes very exactly the equipment and technique for the recovery of displaced solutions. The first criterion to apply to displaced solutions is clearly that of constancy of composition. To determine the concentration of the solutions the author used the depression of the freezing-point, but generally the electrical conductivity. Successive displaced solutions of equal electrical conductivity were obtained from each soil (sandy loams and silty clay loams). The concentration thus measured was in each case the same as that of the liquid obtained without the use of displacing water. When the solution displaced by water from a given mass of soil was used as displacing agent on another portion of the same soil, the newly displaced solution had the same concentration of elctrolytes as the displacing solution. The author is of opinion that this result indicates that the displaced solution has the same concentration as the solution with which it came into contact in the soil.

Concentrations of individual ions in successive portions of displaced solution were determined and the typical differences in behaviour of the various solutes is discussed.

The data collected by the author show that compacted soils tend to become completely saturated during displacement and that the mechanism of displacement consists in an actual translocation of successive layers of liquid.

II. — A new method of obtaining the soil solution was worked out by the Russian TULAIKOW. This author had to study the dry soils of

south-eastern Russia, for which the usual methods of obtaining the soil solution could not be used, the quantities obtained being always too small. Other special methods could not be used owing to the technical difficulties through which the Russian country was passing. This led to the necessity of developing a special method for obtaining the soil solution more quickly in a comparatively large quantity. An apparatus was constructed for this purpose which is based upon the evacuation of the atmosphere within a hollow cylinder, placed within a definite volume of soil. The pressure of the outer atmosphere displaces the water from the soil into this cylinder, as soon as sufficient vacuum has been produced. To obtain sufficient soil solution with a moisture content of less than 50 % saturation and to counteract the molecular forces in the soil, which tend to hold small quantities of moisture, the soil was pressed by means of a common press, in addition to the air evacuation.

The author gives a figure of his apparatus and describes it very carefully. The method allows extraction from varying quantities of soil, within the limits of 100 gm. and 6-7 kgm.

Extracts of the cultivated portion of a dark-brown soil were made by this method. The moisture of the soil was brought to 38.7 % of the absolutely dry soil, corresponding to 90 % of the total moisture-holding capacity, and kept at that moisture for 13 days. The soil solution was then extracted. To determine the uniformity of the solution it was taken out in 15 separate 60 cc. portions. A total of 894 cc. of soil solution was obtained from a total of 2250 cc. present in all the soil. The author's analyses prove definitely the constancy of the concentration of the soil solution. The determination of phosphoric acid did not present any difficulties, due to the high concentration of the soil solution in comparison with a water extract.

Since it was possible now to obtain the soil solution in comparatively large quantities, experiments were carried out on the growth of plants in the solution by the method of water cultures. Wheat, oats, barley, peas, etc., were grown in the green-house to full maturity, on a soil solution taken from a field soil with the natural moisture content.

By the use of this method, it is now possible to determine the osmotic pressure and chemistry of the soil solution in the soil of pot cultures in the different periods of growth of cultivated plants.

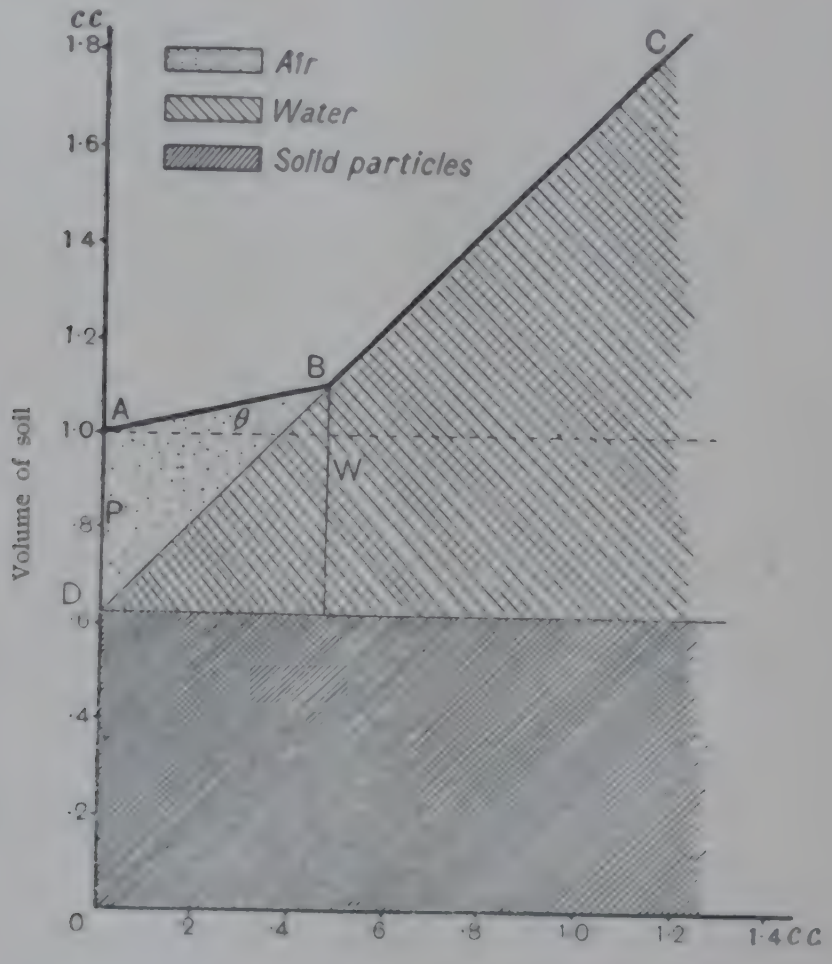
D. v. S.

7. The Volume-changes Associated with Variations of Water Content in Soil.

HAINES, W. B. (Rothamsted Experimental Station, Harpenden). *The Journal of Agricultural Science*, Vol. XIII, part 3, pp. 296-310, figs. 7, Bibl. Cambridge, 1923.

The phenomena of skrinking and swelling which take place in most soils as the water content decreases or increases have attracted very general observation. As a practical agricultural problem, shrinkage in soils comes to the fore in certain tropical clays, where the cracks which open in the

soil in dry weather injure the root systems of the crop and depress yields [1]. But in general the great interest which attaches to the subject lies in the fact that the constant fluctuations in moisture to which most arable soils are subjected, by inducing corresponding shrinking or swelling, constitute a leading factor in the loosening of the structure of the soil and the formation of a good tilth.



Results of shrinkage measurements.

The author describes a new and simple method of measuring the shrinkage of moist soil on drying, which at the same time gives values for the pore space and specific gravity of the soil. The method adopted consists in measuring the volume changes, which a small prism of soil undergoes during a slow drying-out process. The volume measurements were made by displacement of mercury in a constant-volume bottle. The technique consists simply in weighing the mercury required to fill the bottle with and without the soil prism present, and calculating the

(1) See: AUCHENLECK, G. 1912. *West Indian Bulletin*, 12, 50.

displaced volume. Corrections are applied for temperature. The soil prism is weighed at the same time that a reading of its volume is taken.

The author gives diagrams for a number of diverse soils, illustrating the character of soil shrinkage. In these diagrams the "soil volume" is plotted against the volume of water present. The shrinkage is shown to take place in two stages, in both of which there is a linear relationship to the moisture content. That is to say, it is found that the curve obtained by plotting as indicated, consists, to a first approximation, of two straight lines. The first part A. B. of the curve A. B. C. (see figure) making a small angle with the axis, represents the stage where the pore space of the soil is partly filled with air and partly with water. The second part corresponds to the stage where, all the air having been displaced by water, each increment of water is accompanied by an equal increment of volume and the curve takes an upward course at an angle of 45°.

The author explains these two stages of shrinkage by the well-known colloidal-coating hypothesis, and describes confirmatory experiments. D. v. S.

8. **Water Retaining Capacity of Colloidal Soils.**

HARDY, F. *The Journal of Agricultural Science*, Vol. XIII, part 3, pp.340-351. Cambridge, 1923.

The maximum water-retaining capacity of a soil may be defined as the quantity of water, measured as a percentage of the mass of even-dry material, that the soil can retain after it has been thoroughly wetted and then allowed to drain freely. It is generally estimated in the laboratory by HILGARD'S method (HILGARD, *Soils*, 1918, p. 209). The magnitude of the maximum retentivety constant, as estimated by this method depends on the colloid content of the soil (imbibition capacity), on the degree of packing, and on the extent of drainage allowed. BRIGGS and SHANTZ *U. S. Bur. Plant. Indus. Bull. 230*, 1912) have derived an empirical formula connecting the maximun water-retaining capacity (M.) with the hygroscopic coefficient (H.). This formula is: $M = 4.3\ H + 21$.

In these experiments the author employed soils belonging to the diverse geological types represented in the British West Indies (the same as those used in an investigation into the significance of the shrinkage coefficient) (1).

The results indicate that the BRIGG-SHANTZ equation, which is generally applicable to soils whose colloidal properties are not marked, yields values for the calculated maximum retentivety constant that are in considerable deficit of the experimentally determined values, when applied to highly colloidal soils containing *siliceous* colloids. This result is believed to be mainly due to the marked volume expansion shown by these soils when wetted. In the case of red *laterite* soils, in which the colloid content is composed mainly of alumina hydrogel and ferric oxide hydrogel, the calculated values for the maximum retentivety constant, on the contrary are in excess of

(1) See N° 7 of this *Review*. (*Ed.*)

the estimated values. These soils, though highly colloidal exhibit remarkably low volume expansion on wetting.

WILSDON has termed the figure 3.4 in the BRIGG-SHANTZ formula the "vesicular coefficient" of the colloidal material. In the siliceous West Indian soils examined, the vesicular coefficient appears to vary between 4.9 and 3.3 with a mean value of 4.2; whereas, for red laterite soils, it varies between 3.5 and 2.4, the lowest figure being given by the most typical of these.

The author also tested a new formula connecting maximum water-retaining capacity with total bound water and with free interstitial film-water:

$$M = P + 23.5$$

In this formula M represents total colloidally imbibed water and P the moisture content at the point of stickiness and 23.5 is the film water constant by WILSDON. The results obtained indicate that this formula also fails to yield concordance with experimental data, except in the case of laterite soils, for which it seems to apply quite closely. The main reason for failure in the application of the new formula to colloidal soils containing *siliceous* colloids, again appears to be the marked volume expansion, which these soils exhibit when wetted. Interesting results, in general, agreement with those obtained with soils containing inorganic colloids were yielded by two highly ***humic*** soils.

The author finally discusses the significance of some other soil moisture constants, namely the wilting coefficient, the moisture equivalent and the critical moisture content.

The importance of recognising specificity in soil colloidal material is again urged. D. v. S.

9. Effect of Drying and Storage upon the Hydrogen-ion Concentration of Soil Samples.

ROST, C. O. and FIEZER, E. A. *Soil Science*, Vol. XVI, No. 2, pp. 121-126, tables 5, bibliography. New Brunswick, U. S. A., 1923.

It is usually assumed that air-dried soil samples give reliable results for hydrogen-ion determinations, especially if the soils are acid, but the authors' studies have led them to conclude that satisfactory indications are obtained only with samples taken freshly from the field. Their experiments included the effect of air-drying and oven-drying upon the hydrogen-ion concentration of samples and the effect of moistening samples of soil that had become dry and of storing the fresh, moist samples in air-tight containers. Soil samples from five fields upon which liming experiments are in progress showed differences in the *pH* between the fresh soil and dry samples varying from *pH* 0.03 to *pH* 1.17. The acid samples showed as great a change as those that were alkaline. The general tendency was to become more acid. Of 144 glacial and loess soils, all except one became more acid upon air-drying.

Allowing soils to become air-dry generally increased the intensity of the reaction obtained by the qualitative potassium thiocyanate method. Of 78 samples tested, 5 showed no change, 35 a change of one degree of acidity, 19 a change of 2 degrees and 17 a change of 3 degrees.

Oven-drying made almost all samples tested more acid. Samples air-dried and then moistened with distilled-water become more acid.

Soil samples generally become more acid after storage in air-tight glass containers. The amount of change is not related to the degree of acidity or alkalinity.

From the data obtained it is concluded that the only reliable indication of conditions existing in the field are obtained when hydrogen-ion concentration determinations are made with freshly taken soil samples.

W. S. G.

10. **Effect of Chemical Agents on Oxidation in Soil-Forming Rocks.**

Bouyoucos, G. J., (Michigan Agr. Exp. Station). *Soil Science*, Vol. XV, No. 1, pp. 19-22, fig. 1. Baltimore, 1923.

In an investigation on the rate and extent of solubility of soil-forming rocks and minerals it was observed that certain rocks and minerals, when treated with certain chemical agents and allowed to stand, develop different colors in these various chemical agents. This color development appeared to be due mainly to oxidation or lack of oxidation of the iron present, and is greatly accelerated by some chemical agents and entirely prevented by others.

A new or different color developed in most of the rocks and minerals. The most important thing, however, is that chemical agents influence this color development and that each chemical agent is usually regular and consistent in producing the same kind of result in all of the rocks and minerals.

Some of these reagents not only help the oxidation to start, but even accelerate its rate greatly, while others prevent its inception entirely. Calcium nitrate is the best example for the first group and mono-calcium phosphate for the second. Calcium nitrate caused a pronounced oxidation in nearly every rock and mineral. The mono-calcium phosphate not only prevented oxidation but even destroyed the oxidizing influence of the various chemical agents, when mixed with them.

How the various chemical agents influence oxidation so differently is not definitely known. The explanation that seems most probable is that the oxidation in question is caused mainly by catalytic effects. The results throw much light on the oxidation and color of soil at various depths; on the influence of fertilizers on oxidation and color of soils; on the oxidation and color of the substratum of the earth. D. v. S.

11. **Microbiological Analysis of Soil as an Index of Soil Fertility** (1)

I. — Waksman, Selman, A., Ammonia accumulation (ammonification). *Soil Science*, Vol. XV, No. 1, pp. 49-65, bibl. Baltimore, 1923.

(1) See also No. 333 of *Review* No. 3. 1923 (*Ed.*)

II. — IDEM. Methods for the study of nitrification. *Ibidem*, Vol. XV, No. 4, pp. 241-260, bibl. 51 publ. Baltimore, 1923.

I. — Ammonification in solution cannot be used for soil differentiation, for the following reasons:

a) Of the three large groups of micro-organisms, only the bacteria develop in solution, while the fungi and actinomycetes do not usually develop because of the nature of the medium and period of incubation.

b) Of the bacteria, those which develop are only the so-called putrificative forms or those that are able to grow rapidly in liquid media, with peptone or other protein or protein derivate as the only source of carbon and nitrogen. These forms are usually present in all soils, independent of the fertility of the particular soil.

c) Even where differentiation between soils is found it may be due more to the presence or absence of certain minerals in the soil, introduced as an inoculum rather than to the particular soil flora.

Actually no definite correlation was found between ammonia formation in solution on the one hand and crop production, bacteria numbers and nitrification on the other.

Ammonification in soil cannot be used as an index of soil fertility: *a*) all soils contain various groups of micro-organisms that are able to break down complex proteins, with the formation of ammonia. *b*) The final amount of ammonia accumulated in the soil is a resultant of a number of factors, among which are the nature of the protein used in carrying out the test, the presence or absence of available carbohydrates, the initial reaction of the soil and buffer-content of the soil, the rapidity with which the ammonia was transformed into nitrates, which depends upon the initial reaction of the soil, buffer content etc., and the loss of ammonia into the atmosphere.

Ammonification can be used only in comparing the activities of specific cultures of micro-organisms under controled conditions and in studying the course of rapidity of decomposition of organic matter. It cannot be used in determining the nature of soil fertility or soil micro-flora.

II. — Nitrification of ammonium sulphate or other inorganic salts of ammonia in soils having different reactions cannot be used as a basis for comparison. This is due to the fact that the amount of nitrate accumulated in the soil as commonly carried out under laboratory conditions, will depend on the initial reaction of the soil, buffer content and final reaction, more so than on the bacteriological activities; less acid soils will allow a greater accumulation of nitrates than the more acid soils, under a given set of conditions.

In the oxidation of ammonium sulphate, nitric and sulphuric acids are formed. These acids increase the hydrogen-ion concentration of the soil, till a point is reached which becomes injurious to the activity of the nitrifying bacteria. In well buffered soils, such as those receiving large applications of organic matter, greater amounts of acid can be formed, before the injurious reaction is attained than in poorly buffered soils.

Nitrate accumulation from ammonium sulphate in the soil stops when the reaction has reached pH 4.4-4.8. The greater the buffer content of the soil, the greater will be the amount of nitrate accumulated, even if the initial reactions is the same.

Nitrification of ammonium sulphate in the soil should be carried out, in laboratory studies, in the presence of sufficient basic material to neutralize the acids formed from the oxidation of the ammonium salt. Calcium carbonate is to be preferred to calcium oxide, since the latter tends to change rapidly the reaction of the soil, and therefore, bring about various uncontrolled chemical, physical and biological changes.

The nitrification of dried blood, in concentrations commonly employed, namely 1 %, is not a good test for the comparison of different soils. This is due to the different reactions involved in the transformation of dried blood, particularly in alkaline and poorly buffered soils. The rapid decomposition of the dried blood brings about an abundant formation of ammonia, which is not sufficiently neutralized by acids of buffering agents in alkaline and poorly buffered soils. The free ammonia has an injurious action upon the activities of the nitrifying bacteria.

Either low grade nitrogenous materials should be used or a low concentration of high grade materials for the study of nitrification of organic materials in the soil. To get a thorough idea of the nitrifying capacity of a soil and to have a basis for comparing the nitrification of different soils, no one single method is sufficient, but a combination of the following methods is recommended, all of which should be used for each soil, and each of which gives some information necessary to obtain a complete picture of nitrification in the soil:

a) Nitrification in solution, using 10 % of soil for inoculation, as recommended by REMY, LOHNIS and others. The information obtained is valuable for a knowledge of the nitrifying flora of the soil, and the influence of the constituents of the particular soil upon the nitrifying bacteria, when studied under standard laboratory conditions. The use of pure sand is to be preferred to the solution method: 100 gm. of pure washed sand + 210 mgm. Ca CO_3 + 15 cc. of mineral solution, placed in plugged flasks and sterilized in the autoclave; 3-5 cc. of ammonium sulphate solution containing 30 mgm. of nitrogen and sterilized separately are added and each flask is inoculated with 10 gm. of the soil to be tested.

b) Nitrification of the soil's own nitrogen. — A definite amount of soil (100 gm.) kept in the laboratory for a definite length of time (30 days) at a definite temperature (25-28° C), under optimum moisture conditions, will give us information on the forms of nitrogen present in the particular soil and the speed with which they are transformed into nitrates and thus made available for plant growth.

c) Nitrification of ammonium sulphate in the soil. — By using a definite amount of nitrogen (30 gm. in 100 gm. of soil), in the form of ammonium sulphate, and standard period of incubation, we get, from the amount of nitrate formed, an index on the buffering capacity of the soil in relation to nitrification. The final reaction should always be recorded.

d) Nitrification of ammonium sulphate in the presence of a theoretical amount of $CaCO_3$ (210 mgm. for 30 mgm. nitrogen as ammonium sulphate) necessary to neutralize all the acid formed from the complete oxidation of the ammonium sulphate into nitric and sulphuric acid. — This gives an index of the nitrifying capacity of the soil under optimum reaction conditions and forms an excellent basis for comparing nitrification with other soil bacteriological activities.

e) Nitrification of organic nitrogenous materials. — If high grade materials are used (dried blood), 0.1 % concentration should be used and a brief incubation period (10-15 days); 0.25 % concentrations and a period of incubation of 15, or 15 and 30 days, gives important supplementary information.

By giving a definite weight to the information obtained by each of these five methods, a true picture of nitrification in soil may be obtained. D. v. S.

12. Partial Sterilisation of Soil.

I. — RUSSELL, Sir John (Director of the Rothamsted Experimental Station, England). *Soil Conditions and Plant Growth*, 2nd Edition, pp. 114-119. London.

II. — HALL, Sir Daniel (Scientific Adviser, Ministry of Agriculture, Great Britain, late Director, Rothamsted Experimental Station). *The Book of the Rothamsted Experiments*, pp. 273-285. London, 1919.

III. — WAKSMAN, S. A. and STARKEY, R. L. (New Jersey Agricultural Experiment Station). Partial Sterilisation of Soil, Microbiological Activities and Soil Fertility. *Soil Science*, Vol. XVI, No. 4, pp. 247-267, and No. 5, pp. 343-356. Baltimore, U. S. A., 1923. — See also appended bibliography.

I. — As far back as 1877 OBERLIN used carbon disulphide to kill phylloxera, and GIRARD in 1887 to clear a piece of sugar-beet ground infested with nematodes; in each case subsequent crops showed that the productiveness of the soil had been increased by this treatment. In 1889 KOCH noted that carbon disulphide stimulated root growth and four years later HILTNER and STÖRMER showed that the bacterial flora was altered by this substance, and afterwards they found that the number of organisms was ultimately increased, although there was a decrease of about 75 % at first. FRANK in 1888 found that the effect of heat was to increase the soluble mineral and organic matter in soil and make it more productive. Experiments by RUSSELL and DARBISHIRE [10] showed that the rate of oxidation was reduced after soil had been heated to 130° C., but was increased by small quantities of volatile antiseptics and more than doubled after heating to 100° C. The increase of available plant food material in untreated and heated soil was found to be, respectively, as follows: N_2, 2.30-4.43 %; P_2O_5, 1.06-2.68 %; K_2O, 4.20 - 5.62 %; the dry weight increase of crop (mustard) grown on this soil was, untreated soil, 15.88 gms., heated, 24.33 gms. RUSSELL and HUTCHINSON [11] showed that the most striking chemical changes that set in after partial sterilisation are the cessation of nitrification and an accumulation of

ammonia much in excess of the sum of ammonia and nitrate in the untreated soil. The experiments indicate that the increased production of ammonia is due to increased numbers of bacteria ; the untreated soil appears to contain some factor detrimental to bacteria which is put out of action by heat or antiseptics. Bacteria would be largely destroyed also, but the spores would survive and having a free field would multiply rapidly. As the factor did not appear to be bacterial, search was made for larger organisms such as protozoa, but none were found in the heated soil, however, untreated soil contained a variety of them, and the evidence seems to show that such organisms constitute one of the factors limiting bacterial activity, and therefore, fertility in ordinary untreated soils.

The micro-organic flora of a soil thus appears to be very mixed; saprophytes, parasites attacking plants and apparently also living on and decomposing organic matter, and larger organisms inimical to bacteria all seem to be present.

The detrimental organisms are killed by any antiseptic vapour, or by heating the soil for three hours to 55°-60° C ; cooling to low temperatures depresses, but fails to kill them. Once these organisms are killed the only way of re-introducing them is to add some untreated soil (12).

As media for plant growth partially sterilised soils differ from untreated soils in several particulars (13). There is generally a retardation of germination ; generally an acceleration in growth up to the time of appearance of the third or fourth leaves, but sometimes retardation, especially in rich soils heated to 100° C. ; this retardation is accompanied by a very dark green leaf colour and either the formation of a purple pigment or a tendency for the leaves to curl towards the under side ; later on the purple colour goes and the curling ceases. Plants grown in soils heated to 100° C. show a very remarkable development of fibrous root ; the leaves are larger and the colour is deeper, the stems are stouter and the internodes usually shorter ; they flower earlier, more abundantly and contain a higher percentange of N_2 and sometimes of P_2O_5 in their dry matter.

The action of caustic lime has been found to be intermediate between that of volatile antiseptics and the changes induced by high temperatures (5).

The non-volatile antiseptics, such as quinone and hydroquinone all produce a permanent depression in bacterial numbers with the highest doses ; the alcohols proved to be ineffective ; formaldehyde was less potent than was anticipated.

The application of crude petroleum inhibits most types of bacteria although some are stimulated ; moulds are not inhibited. When first applied, nitrate production ceases in the soil (1).

Experimental evidence proves the existence in the soil of a protozoan fauna in the trophic, as distinct from the encysted state (9).

The three chief groups of protozoa inhabiting the soil are : *Rhizopoda* or *Amoebae*, *Mastigophora* or *Flagellata* and *Ciliata* (10)

The protozoan fauna is practically confined to the top six inches of the soil. There is a definite inverse relation between the numbers

of bacteria and amoebae. The richer the soil is in organic matter the richer it is in protozoa.

The numbers of protozoa vary so rapidly that it was found necessary to institute daily counts, which revealed the fact that there is a daily variation in the number of trophic forms of the flagellates, *Oicomonas* sp. (Martin), *Cercomonas longicauda* and *Bodo* sp., in the soil of arable fields. Temperature and rainfall appear to have no influence on the number of active protozoa in the soil (3).

The results of 365 consecutive daily counts showed that the numbers of bacteria and protozoa fluctuate greatly and that there are well-marked seasonal changes in the soil population, both bacteria and protozoa being most numerous at the end of November and fewest in February. An inverse relationship was found between the numbers of bacteria and amoebae in 86 % of the total observations (4).

Samples of soil and mosses brought from Spitzbergen by the Oxford University expedition of 1921 and 1922 were found to contain an abundant protozoan fauna, practically identical with that of soil and mosses of temperate lands (14).

II. — The investigation of the biochemical processes of the soil has taken place in three directions. Efforts have been made to discover and then to describe the organisms concerned in the processes. Chemists have tried to find out the steps by which the changes occur. At Rothamsted work has been directed to the discovery of the conditions under which the organisms live, with the view of ultimately obtaining some degree of control over them.

Investigations have led to the following conclusions: Partial sterilisation of soil causes first a fall and then a rise in bacterial numbers, until they exceed those originally present in the soil, and at the same time there is a marked increase in the rate of accumulation of ammonia, which is attributed to the bacteria; the ammonia is formed from organic nitrogen compounds. The increase in bacteria is the result of improvement in the soil as a medium for bacterial growth and not to an improvement in the bacterial flora. The improvement in the soil is permanent, the high bacterial numbers being kept up for 200 days or more.

The factor limiting bacterial numbers in ordinary soils is not bacterial, nor is it any product of bacterial activity, nor does it arise spontaneously. If some untreated soil is introduced into partially sterilised soil, the bacterial numbers, after the initial rise, begin to fall.

The properties of the limiting factor are: It is active; it is not bacterial; it is extinguished by heat or poisons. It can be reintroduced by the addition of untreated soil; it develops more slowly than bacteria, and causes a marked decrease in the numbers of bacteria; it is favoured by conditions favourable to trophic life in soil, and finally becomes so active that bacteria become unduly depressed.

The parallelism between the properties of the detrimental factor and the protozoa is not proof that the latter constitute the limiting factor, but the evidence is sufficient to justify further examination, as these

protozoa lead an active life in the soil, and one result of their activity is to keep down the numbers of bacteria.

The difficulties inseparable from investigations on the micro-organisms of soils are drawn attention to by Rossi (8), particularly as regards the complexity of the physico-chemical structure of soils and the presence of hydrosols that may be coagulated by heat, also the mistake of attributing to a bacterium in soil, only the properties which that bacterium shows *in vitro* after isolation.

III — It has been shown that treatment of soil with volatile antiseptics and heat has an important influence on the development of bacteria and protozoa, soil actinomycetes and especially upon soil fungi.

Field soils present great difficulties owing to their variability as regards chemical composition and numbers of micro-organisms The determination of ammonia formation alone in the soil is not a reliable index as to bacterial activity, because it is subject to too many variables, and also, because fungi develop rapidly in partially sterilised soil and accumulate ammonia or convert it into microbial protein.

In order to obtain a soil in which the history of microbial changes was known, the authors (Waksman and Starkey) made a study of some air-dried, sieved sassafras loam soil, to which water was added to 60 % of its total moisture holding capacity After eleven months a uniform balance of microbiological activities had become established, and the 60 pots of soil were divided into groups and subjected to various treatments.

The mere mixing of soil caused a slight depression in bacterial numbers ; protozoa were not affected ; fungi were at first depressed, then stimulated.

The addition of 0.5 % CaO had a sterilizing effect and depressed the numbers of bacteria and fungi and destroyed the protozoa. Exposure to the air caused a rapid increase of micro-organisms ; after 28 days large numbers of ciliates, flagellates and amœbae were found in the soil.

The addition of $CaCO_3$ caused a slight increase of bacterial numbers, but there was no sterilisation effect, nor was the soil equilibrium affected.

Air-drying the soil, followed by moistening with water, caused increase in numbers of bacteria and fungi and in CO_2 production, accompanied by a decrease in nitrates. The effect is only of short duration. Protozoa were not destroyed. Ammonia did not accumulate appreciably. The experiment showed that air-drying modifies the organic matter of the soil and makes it a more available source of energy for micro-organisms.

Heating of soil at 65° C. for one hour caused a decrease in the number of bacteria and fungi, followed by an increase ; there was a rapid increase in CO_2, followed by a decrease ; protozoa disappeared and did not reappear in any numbers until after 28 days. The nitrate content, after a slight increase, continued to decrease. The ratio of actinomycetes to the total number of micro-organisms was about 30 % before heating, but fell to 15 % after heating, and about 3 % two weeks later ; a gradual in-

crease followed ; but even 4 months after treatment their ratio was only one-fourth of that before treatment.

The addition of toluene caused an increase in bacterial numbers and CO_2 production ; the CO_2 rapidly decreased, but the bacteria remained at a high level, even after 130 days. Fungi were almost destroyed, and then increased and reached a higher level than the control. Actinomycetes were about 10 % of the flora instead of 30 %. Protozoa disappeared until after 28 days.

Treatment of soil with 1 % carbon bisulphide resulted in phenomena similar to the toluene treatment, heating, air-drying and CaO addition. Protozoa were absent after 14 days, and began to reappear in 28 days ; bacteria were depressed, then increased, reaching a maximum in 90 days ; actinomycetes, even after 120 days did not reach more than one-third of the original proportion ; the ammonia content increased from less than 1 mgm. to more than 3 mgm. per 100 gm. of soil.

It has been shown that partial sterilisation depresses the fungi and protozoa and stimulates bacteria, and causes an increase in the ammonia content of the soil, especially if it is rich in organic matter.

The authors' work may be summarised as under :—

1) Partial sterilisation of soil makes the organic matter more available as a source of energy for micro-organisms.

2) A large proportion of the fungi are killed, and the dead material with the bodies of destroyed protozoa still further increases the amount of available energy in the soil.

3) The rapid increase in soil micro-organisms is at the expense of the organic matter made available. The increase of fungi may be due to abundance of spores.

4) The proportion of carbon and nitrogen present depends upon the physical and chemical condition of the soil ; when the carbon compounds are decomposed as sources of energy by bacteria and actinomycetes some of the nitrogen is left as a waste product, which explains why the development of these two groups of organisms bring about the liberation of nitrogen from the soil organic matter to a greater extent than in the case of the development of the fungi.

5) The actual amount of ammonia formed is determined not by the numbers, of bacteria and fungi in the partially sterilised soil, but by the abundance of organic matter.

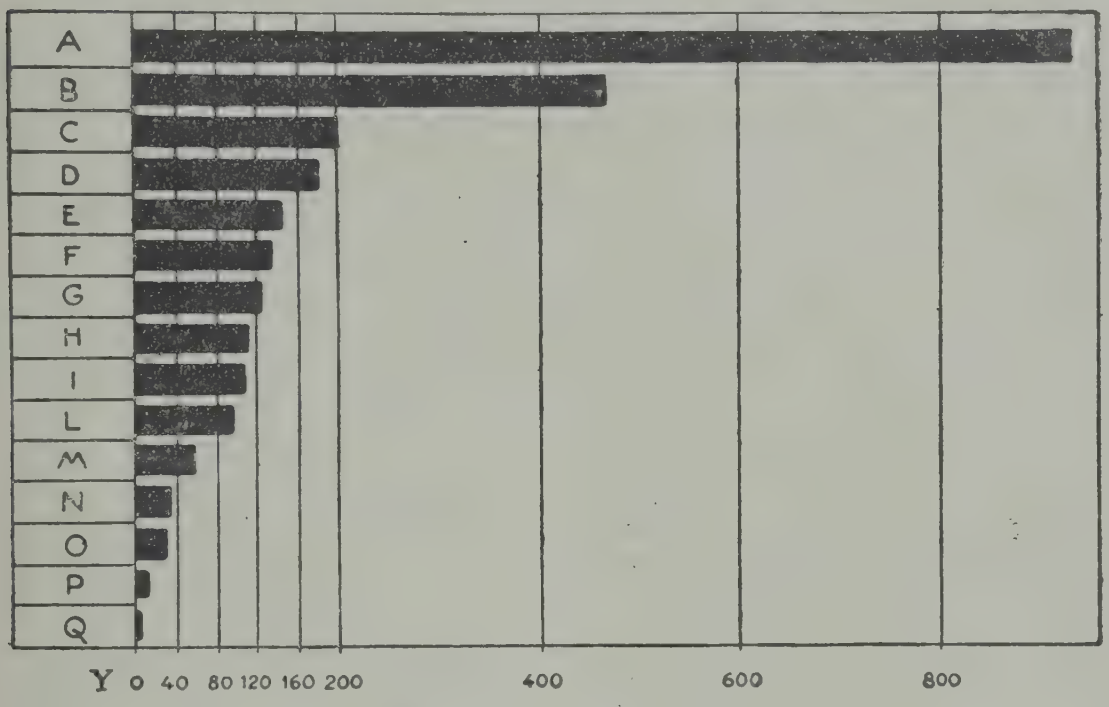
6) Protozoa are suppressed, but become active again long before the bacterial numbers drop down very markedly.

7) The more rapid the rise in bacterial numbers and the greater the maximum, the sooner will the fall set in, as these phenomena are results of the amount of available plant food in the soil.

8) The phenomena observed are explained by the change in the physical condition of the soil, especially the colloids ; the rendering more available of organic matter ; the destruction of fungi and protozoa, making their bodies available as sources of energy for the surviving micro-organisms ; the change of flora in favour of bacteria ; the fact that bacteria

use organic nitrogenous substances as sources of energy and liberate as waste products ammonia as well as phosphates and other minerals contained in the organic matter.

Carbon dioxide production effected by various treatments, and total production during first week after treatment.



A = Alfalfa meal.
B = Calcium carbonate.
C = Toluene Reinoc.
D = Toluene.
E = Air Dried Reinoc.
F = Air Dried.
G. Carbon disulphide, Reinoc.
H = Carbon disulphide.
I = Heated Reinoc.
L = Heated.
M = Weathered.
N = Phosphorous + Potash + Nitrogen.
O = Phosphorous + Potash.
P = Cultivation.
Q = Sulphur.
Y = Milligrams of Carbon dioxide.

9) These results apply to normal soils. Under certain conditions other factors become predominant, as for instance in the case of soils infested with fungi causing plant diseases or sewage farming or greenhouse soils, where protozoa may become controlling factors.

Soil sterilisation has had a practical application in eliminating diseases in greenhouses and infected fields.

It is an established fact that partial sterilisation of soil increases plant growth and to explain this, various theories have been advanced, such as KOCH's theory of direct stimulation; HILTNER and STORMER's of indirect stimulation; LIEBSCHER's view that it may be regarded in the same light as a nitrogenous fertiliser; RUSSELL and HUTCHINSON's protozoan theory of soil fertility; PICKERING and SCHREINER's contention that the alteration in chemical composition is largely responsible for the increase of plant growth, and GREIG-SMITH and others who adhere to the bacterio-toxin hypothesis (6) W. S. G.

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13. **Influence of Soil Condition on Bacterial Life and Changes in Soil Substance.** (1).

CHRISTENSEN, H. R. (Statens Planteavls-Laboratorium, Lyngby, Denmark). Ability of soil to break down mannite. *Soil Science*, Vol. XV, No. 5, pp. 329-360, bibl. Baltimore, 1923.

In articles already published by the author (1914 Studier over Jordbundsbeskaffenhedens Indflydelse paa Bakterielivet og Stofomstningen Jorbunden. *Tidsskr. Landbr. Plant eavl.*, v. 21, p. 395; German translation, Studien über den Einfluss der Bodenbeschaffenheit auf das Bakterienleben, *Centl. Bakt.*, abt. 2, v. 43, p. 1-166), he described preliminary investigations of the capacity of soil to break down mannite.

These investigations, show that the capacity of the soil to break down this substance, as well as an entire series of other organic substances, depends largely on their chemical condition. The soil content of basic lime and of phosphoric acid combinations, determine the speed at which mannite decomposition takes place. The results of the author's experiments seem to indicate that a determination of the speed of mannite decomposition in non-lime-requiring soils, gives information as to the soil's content of easily soluble phosphoric acid compounds readily assimilated by plants, in the same way as the author's azotobacter test expresses the need of the soil for lime.

D. v. S.

14. **A New Apparatus for Mechanical Analyses of Soils.**

JOHNSON, H. W. (Iowa Agricnltural Experiment Station). *Soil Science*, Vol. XVI, No. 5, pp. 363-366. figs. 5. Baltimore, U. S. A., 1923.

The author gives a preliminary description of an apparatus for obtaining a better conception of the physical constituents of soil.

The apparatus is somewhat similar to SVEN ODEN'S balance, in which the soil particles suspended in water are allowed to settle upon the pan of the balance; by means of mathematical calculations a distribution curve is then obtained.

The author's apparatus eliminates these complicated calculations as it draws the distribution curve itself by means of a recording arrangement. The friction caused by the usual recorder has been avoided by making the record electrically; momentary contacts at regular intervals cause sparks to jump from the point at the end of the beam to the revolving cylinder, passing through the record chart and burning small holes, which are sufficiently numerous to allow of the drawing of the required curve.

W. S. G.

(1) See also, *Review*, 1922, No. 234. (*Ed.*)

15. The Effect of Wear on Small Mesh Wire Sieves.

KEEN, B. A. and HAINES, W. B. (Rothamsted Experimental Station, England). *Journal of Agricultural Science*, Vol. XIII, Part 4, pp. 467-482, Plate I, figs. 9. Cambridge, 1923.

The authors' investigations were undertaken to measure the uniformity of new sieves with respect to the linear dimensions and area of the holes and the diameter of the wire, also to compare these with the corresponding measurements of used sieves, employed in the mechanical analysis of soils, etc.

The measurements were made with a microscope, using a low-power objective (30 diam.), and a graduated scale placed in the focal plane of the eyepiece, the results obtained being plotted as frequency diagrams.

A number of frequency curves showed double peaks, and actual observations showed that there was a systematic distribution of values corresponding to these two peaks. This might indicate displacement of one of the combs during weaving, thus giving alternate strands of wire and narrow holes.

The double and single systems of weaving were compared ; the single design seems preferable for maintaining uniformity of hole dimensions in use, although it is neither as strong not as durable as double weaving.

A test showed that a new double-weave sieve passed 0.4 % of material which it should have held ; an old double-weave sieve passed 1.6 %, and an old single-weave sieve passed 0.9 % of material it should have held.

It may be generally concluded that the holes in a new sieve woven according to the 1 mm. specification do not vary greatly from the theoretical size, but worn sieves show considerable fluctuations in mesh sizes. The rubbing action used to pass material through the sieves produces relative movement of the wires and causes variation in mesh area between the wires. W. S. G.

16. The Litmus Method for Detecting the Soil Reaction.

CARLTON, E. A. *Soil Science*, Vol. XVI, No. 2, pp. 91-94, tables 2. New Brunswick, U. S. A., 1923.

Blue litmus paper in contact with an acid soil slowly changes in colour, the speed and completeness of the change depending upon the total acidity as well as the p*H* value. The object of the author's experiment was to ascertain which of these had the greatest influence on the change in colour.

It was shown that the litmus paper test depends on the hydrogen-ion concentration of the soil.

The three shades of colour assumed by the paper are described as pink, slightly pink and very slightly pink with p*H* ranges of 4.8-5.2, 5.2-5.8, and 5.8-6.7.

It is pointed out that the changing of colour of red litmus does not indicate that a soil is basic unless the proper blue colour of the paper is restored. W. S. G.

Fertilisers and Manures.

17. Field Trials with Artificial Farmyard Manure.

GARRAD, G. H. *Agricultural Gazette and Modern Farming*, Vol. XCVIII, No. 2608, p. 791. London, 1923.

Exhaustive investigations have been carried out at the Rothamsted Experimental Station by RICHARDS and HUTCHINSON to perfect a process whereby straw could be converted into farmyard manure without the agency of livestock. The author gives an account of the testing of this process on some stacks of straw under ordinary farm conditions, and the subsequent utilisation of the artificial farmyard manure.

The stacks were built in the following manner:— Straw was laid down to the depth of about one foot and on this was sprinkled powdered chalk, the straw then being sprayed with water until saturated. This was continued until the stack was 10 feet high, when neutral sulphate of ammonia was applied on the top and well washed in until it had thoroughly penetrated the stack.

In the course of a few days the temperature of the stack had risen, and after about three months the straw had broken down into a brown humus, very much like ordinary farmyard manure.

The treatment of 32 tons of straw was carried out in June, 1922, on a farm in the Romney Marsh, and 5 months later the resulting artificial farmyard manure, and also some bullock dung from the same farm, were analysed, the results being as follows:—

	Artificial Farmyard manure	Bullock manure
	%	%
Nitrogen	0.48	0.37
Phosphate (as tri-calcic)	0.16	0.27
Potash	0,27	0.21
Organic matter	12.60	11.10

Field trials were then carried out with oats to compare the values of both manures, adjustments being made so that equal quantities of nitrogen, phosphate and potash were given to each plot.

The resulting yields of spring oats were:—

	Grain		Straw
	Qrs.	bus.	cwt.
Plot. 1. Art. farmyard manure + artificials	6	6	36 1/4
2. Art. farmyard manure only	6	2	32
3. Bullock dung from manure heap	5	6	31 1/2
4. Rough and dry dung from yard	4	6	32 3/4
5. Straw + artificials	4	2	28 1/2

If the straw is not uniformly treated patches will remain unrotted, however, such straw can be thrown on the next stack and retreated. An improved method has recently been devised which, it is claimed makes a more uniform product, at a lower cost than that described above. It has been found that one ton of straw will make about 3 tons of artificial farmyard manure, the cost of treatment being about 7*s* per ton of rotted manure. W. S. G.

18. Fertilisers from Dried Locusts (1).

The South African Journal of Industries, Vol. VI, No. 12, pp. 565. Pretoria, 1923.

An industry has just been started in Johannesburg for the manufacture of cattle meal and poultry food from dried locusts, but, for the present it is intended to concentrate on the manufacture of fertilisers.

The raw material is being obtained through farmers, who are offered 2 *s.* per bag for the dried insects delivered to the nearest railway station.

The analyses of the new locust meal are as follows :—

1) Meal prepared from Voetgangers. — Moisture, 5 %; ash, 22.5; silica 19.54; protein (nitrogenous matter), 49.87; ether extract, 8.05; iron and alumina, 1.06; lime, 0.2; phosphoric oxide, 0.96; potash, 0.72; magnesia, trace; crude fibre, 3.44.

2) Meal from Winged Locusts. — Moisture, 5 %; ash, 20.85; silica, 17.32; protein, 39.93; ether extract, 17 24; iron and alumina, 1.0; lime 0.15; phosphoric oxide, 1.4; potash, 0.74; magnesia, trace; crude fibre, 3.5. W. S. G.

19. Wool Washing and its Products including Potash Recovery.

Rindl, M. *The South African Journal of Industries*, Vol. II, No. 12, pp. 628-632. Pretoria, 1923.

Reference is made to experiments carried out on Australian merino wools to test the potash value of scoured wool. From stained pieces and locks, between 4.5 and 6.25 % was obtained and it appears that these portions are richer in potash than the backs and flanks from which clean fleece wool is taken. The author considers it advisable to apply these results to the wool scouring industry in South Africa, where the high price and consequent shortage of potash fertilisers is a serious handicap to agriculture. A review is made of the methods of extraction employed in the United States and in Europe. It has been found that in the first centrifuging process only 75 % of the grease is removed from the liquor. By using the scouring material repeatedly and centrifuging every time it is saturated with grease, it can be used four or five times and a 6.8 % solution of potash obtained. This has proved a more economic proceeding and the cost of initial evaporation is eliminated, besides giving a softer quality wool. According to Havrez potassium ferrocyan-

(1) See *R.* 1919, No. 690: *R.* 1921, No. 18. (*Ed.*)

ide obtained when the yolk mixed with iron filings is submitted to dry distillation is of high commercial value.

The author does not consider the idea feasible of using potash salts thus recovered, as a fertiliser without further treatment, as these materials would only clog the soil.

Data are given relative to potash recovery in the United States and in Germany, followed by a general survey of the wool scouring industry in South Africa. The question of crude wool grease is discussed and the commercial valuation compared with English wool grease. The importance of solvent-extracted grease is urged, in conjunction with the possible recovery of potash. M. L. Y.

20. The Manurial Properties of Lead Nitrate.

BERRY, A. R. (Professor of Chemistry, West of Scotland College of Agriculture). *Journal of Agricultural Science*, Vol. XIV, Part 1, pp. 58-65. Cambridge, 1924.

Lead compounds in relatively high concentrations are plant poisons, although at low concentrations they may act as stimulants.

The action of lead nitrate upon plant growth is complicated by the fact that: 1) the salt supplies nitrogen in an available form; 2) its fertilising properties may be destroyed by the toxicity of the lead; 3) there may be interaction between the salt and the soil constituents. To elucidate some of these points, water culture, pot and field experiments were undertaken.

As a result of the investigations it was found that: Lead nitrate, as a source of nitrogen for fertilising purposes is equal to nitrate of sodium, when applied in quantities equivalent to those employed in agricultural practice. Its effect on the plant was to produce a slightly broader leaf blade and a deeper shade of green, compared with the effect produced by nitrate of sodium. No difference in root development was found. Used in the amounts given in these experiments, no trace of lead could be found in the plant, nor could any lead be detected in a water extract of the soil.

Except in solutions of fairly high concentration, soil adsorbs the lead and destroys the toxicity of soluble lead salts.

There was no evidence to show that the addition of lead salts increased the rate of nitrification in soil. W. S. G.

21. Protection of Sacks of Fertilisers.

BRUNO, A. (Ingénieur agronome). Les sacs à produits chimiques. Leur protection contre la corrosion chimique. *Comptes Rendus des Séances de l'Académie d'Agriculture de France*, Vol. 9, No. 33, pp. 841-843. Paris, 1923.

Sacks intended to hold acid substances have been treated with a mixture called " Albla " composed of carbonate of calcium and algae ground to powder. Sacks thus protected cost 10 % more than others, but they last more than twice as long.

[20-21]

Dynamometric experiments have proved that the treated sacks : 1) are stronger than the control sack before use ; 2) are in a better condition than the latter after use, especially when the conditions have been harder and the contact longer ; 3) continue usable for a variable length of time after the control sack has had to be discarded. Further, the texture of the sack when treated becomes closer than that of an ordinary sack.

The author tested the resistance shown by the treated sacks to caustic and alkaline compounds and to the alkaline earths. For this purpose, he employed sulphate of magnesium, as being the salt of a strong acid, but a weak base, and at the same time inert and cheap. Even when hot, a solution of magnesium sulphate does not act upon carbonate of lime, and the mixture of these two salts that are incapable of reacting upon one another has the property of neutralising both acids and bases. R. D

Agricultural Botany.

22. Stimulation of the Vital Functions of Cells and Its Importance for Agriculture.

Popoff, M., in Стимулиране на клѣтъчните функции и значение му за земеделието. *Естествознание и География* (Natural Sciences and Geography), Year VIII, Parts 1 and 2, pp. 1-6. Sofia, 1923.

Numerous experiments begin by the author as long ago as 1914, have induced him to conclude that the stimulating action exercised by some chemical substances on the vital activity of the cell is the result of the intensification of the respiratory process and of oxidation, as well as of the combined assimilation processes of the cell.

In order to explain this action chemically the author starts from the hypothesis that the structure of the living cell like that of a molecule of aromatic compounds consists of a central nucleus and many lateral chains. Some of the latter have the function of absorbing the oxygen of the air and of passing it on to other parts of the molecule. In this way, there would be a circulation of oxygen in the living cell. When the lateral chains are saturated with oxygen, the circulation of this gas would become slower and the vital processes of the cell less rapid. In order again to increase the speed of oxidation and of the oxidation processes, it is necessary to create free passages for the oxygen in the lateral respiratory chains. This can only be effected by acting on these chains by means of chemical reducing substances, which by removing the oxygen leave the way open for a further absorption of this element on the part the cell. Consequently, the living molecule, when afterwards placed in an environment rich in oxygen, will become the centre of a new circulation of oxygen accompanied by an intensification of the vital functions. If this action is exerted upon embryonic cells, they receive a fresh impulse that may influence the whole life of the individual. If on the other hand, the deoxidising action is too much prolonged, the cell perishes.

Starting from this hypothesis of reducing compounds that alone can act under certain conditions depending upon the concentration of

the solution and exercising a stimulating influence upon the living cell, the author carried out many experiments, both in the laboratory and later in the field, with substances that can be divided into the following groups :

1) CO and CO_2 ;
2) Certain salts of Mg, Mn, K, Fe, Na, P, Cu and Hg ;
3) Arsenic and its compounds ;
4) Some alcohols and carbohydrates ;
5) Compounds of the group of the aldehydes, ketones, and fatty acids.
6) Glucose and its compounds.
7) Phenols (mono- bi- and tri-valent and their easily oxidised compounds, also the aromatic acids from mono-to polyvalent.
8) Some hypnotic and anaesthetic substances, and also easily-oxidisable alkaloids.
9) Certain turpentines and camphors.

Locality Farm	Crop	Yield per $^1/_{10}$ hectare in kg.	
		Seed treated with stimulants	Control
		kg.	kg.
Plovdiv M. Baltov's farm	Barley	227, 268, 274	202
Pazardijik Agricultural School . . .	Barley	294, 214, 241	187
Stara Zagora Horse-breeding farm .	Oats	135, 140, 160, 168	100
	Oats	171, 188, 193, 212 .	137
Plovdiv Horse-breeding farm. . . .	Oats	212, 220, 240, 267	143
	Wheat	175, 190, 204	155
Stara Zagora M. Manev's farm. . .	Wheat	166, 174, 190	144
Stara Zagora Nursery	Millet	160, 171, 181, 208	133
Aitos Agricultural School	Rye	253, 279	218
Borush Agricultural School. . . .	Wheat	204	126
Sadoco Agricultural School.	Oats	158, 166, 176	122
	Vetch	68, 70, 80	60
Plovdiv M. Baltov's farm	Rice	215, 244, 269, 246, 306	168
Plovdiv M. Lukoff's farm	Rice	345, 414, 417, 484, 490	310
Plovdiv Horse-breeding farm. . . .	Mangels	3250, 3625, 3800, 4100, 4600	2898
Stara Zagora Horse-breeding farm .	Maize	220, 240, 252	182
Plovdiv Horse-breeding farm. . . .	Chick-peas	133, 146, 157	87
Stanimaka Co-operative for tobacco growing	Tobacco	Height of plant m. 1,42 Leaves 28-34	1,07 18-34
Varka	Maize	327, 347, 355	288
Vidov	Wheat	214, 256	166
Kabiuk	Millet	310, 340, 400	120
	Millet	270, 280	190

The author experimented with these substances in various ways, injecting them into small branches, treating seeds with their solutions and testing their effect upon unicellular organisms. The experiments of most value to agriculture were made in 1923, on the seeds of cultiv-

ated plants over an area of 45 hectares. The following table gives a summary of the results obtained together with the locality, the farm where the experiment was carried out, the yields obtained, from the seeds treated with stimulating solutions and the control seeds respectively.

The data here given show that by stimulating the seeds it is possible to increase the yield of cultivated crops 20, 30, 40, 50 %, and even more. Even if we leave out of account the highest figures, we get a certain increase of 25-30 %, and in the case of rice, of 40 %. The author intends to carry out these experiments on a larger scale in 1924. This method of seed stimulation has also been practised, under the author's direction, in other countries as well as Bulgaria, viz., in Germany, Czecho-Slovakia, Hungary, etc.

A detailed account of the method will be given in a book shortly to be published, but in the meantime, the author refers his readers to several papers he has published on the subject in Bulgarian and foreign reviews. T. G.

23. The Adaptability of the Mesquite *(Prosopis juliflora)* to Conditions in India.

KUNHIKANNAN, K. (Department of Agriculture, Mysore). A Useful Plant for India. *Agricultural Journal of India*, Vol. XVIII, Pt. II, pp. 144-147, figs. 1. Calcutta-London, 1923.

The author has recently introduced seeds of the mesquite (*Prosopis juliflora*) from California for trial in India and tests have also been made with seedlings from Hawaii which are thriving well in Bangalore. Satisfactory reports have been received from various districts and the experience available appears to prove the adaptability of this valuable plant to Indian climatic conditions, and encourages its introduction into other localities.

A botanical description is given of the tree and attention is drawn to the nutritive value of the pods (especially as cattle food) and of the honey tree (a tree of about 30 ft. across is estimated to produce 2½ lb. honey). Apart from its ornamental value, the economic worth of the wood for furniture and cabinet work should be remembered. M. L. V.

24. A Method for the Quantitative Estimation of Tannin in Plant Tissue.

MENAULT P. (Research Chemist, Oklahoma Agricultural Experiment Station). *Journal of Agricultural Research*, Vol. XXVI, No. 6, pp. 257-258. Washington, D. C., 1923.

The literature of this subject makes no mention of a process for the estimation of small quantities of tannin in plant tissues. The author made a study of the grain-sorghums and describes the method used for this purpose, in which a colour-reagent is employed. The colour reagent is made by boiling 100 gm. of pure sodium tungstate, 50 gm. pure arsenic acid (As^2

O^5) with 300 cc. water and 50 cc. conc. hydrochloric acid for two or three hours under a reflex condenser. The solution is then cooled and diluted to 1 litre.

Among other results quoted are included, darso 0.4 % tannin ; white kafir, trace ; African millet 2.7 ; broom corn 4 %. M. L. Y.

25. Plant Physiology.

WEST, Dr. CYRIL (Low Temperature Research Station, Cambridge). *Science Progress*, Vol. XVIII, No. 71. London, 1924.

The author gives a brief summary of recently published works on the behaviour of plants and plant tissues when exposed to frosts or low temperatures.

One of the first indications of first injury is due to the withdrawal of water from the cells, and the displacement by this water of the air in the intercellular spaces. In some plants the frozen cells are stimulated to abnormal growth, tumour-like outgrowths being produced, similar in many respects to those produced in the plant by pathogenic organisms. Cabbage plants which had been " hardened " by being kept at 3° C for five days withstood exposure for half an hour to —3° C, whereas the control plants were killed. It is believed that this resistance may be attributed to a change in the proteins of the protoplasm. An increase in the amido-acid content of the hardened plants takes place, but carbohydrate changes are slight.

It has been found that fruit buds of the apple, peach, cherry and apricot, show different degrees of hardness at different stages of development, and these differences are attributed to changes in the quality and concentration of the cell-sap.

Potato tubers when frozen solid are killed and collapse on thawing ; if the freezing is less severe they may appear sound externally, but when cut open show signs of internal frost necrosis, discolouration of the vascular network being usually the most obvious change. The conditions necessary to produce frost necrosis are exposure to —10° C for one hour, to —5° C for two hours or to —3° C, for several hours.

The freezing point of potatoes tends to rise as the season advances, and varies with different varieties ; early and mid-season varieties generally have a higher freezing-point than late varieties.

The success or failure of fruit and vegetable cold storage depends not only on the lengthening of their cold storage life, but also upon the maintenance of such conditions as will allow the various physical and chemical changes, termed " life processes, " to proceed without interruption. At low temperatures these processes may be profoundly altered.

Apples have been shown to be more susceptible at low temperatures, to brown heart, a functional disease, than at ordinary temperatures.

W. S. G.

26. Fermentation and Germination of Wheat and Sunflower Seeds.

BACH, A. and OPARIN, A. Über die Fermentbildung in Keimen der Pflanzensamen. *Biochemische Zeitschrift*. Vol. 134, Nos. 1-4, pp. 183-189. Berlin.

Researches on ferments (Katalases, peroxydases, oxydases, amylases and proteases) formed simultaneously at the germination period of wheat and sunflower seeds. D. v. S.

27. Physical Factors influencing Plant Growth.

CREMIEU, V. La croissance des vegetaux et les principes de la physique. *Comptes rendus de l'Académie des Sciences*. Vol. 176, No. 4, p. 295. Paris, 1923.

The author discusses the growth of the plant in relation to internal forces acting in the primary cells. D. v. S.

28. Further Observations on the Osmotic Pressure of the Juices of the Potato Plant.

LUTMAN, B. F. *Journal of Agricultural Research*, Vol. XXVI, No. 6, pp. 243-246, tables 10. Washington, D. C., 1923.

Confirmation of results previously obtained with reference to the high osmotic pressure in the cell sap of potatoes compared with that of the old leaves, stems or new tubers. Results of four years experiments are given with detailed records of cryoscopic readings. M. L. Y

29. Study of the Reproductive Organs of the Oil-Palm.

VANDERYST, H. (Agricultural Expert at Kisantu, Belgian Congo). Etude botanico-agronomique des organe reproducteurs de l'*Elaeis*. *Bulletin de l'Association des Planteurs*, Vol. X, Nos. 11 and 12, pp. 198-203. Antwerp, 1923.

This article is an abstract from the author's work entitled " Introduction à l'étude du palmier à huile " (still in course of preparation), and contains an account of the spadices and fruit bunches of *Elaeis guineensis*. R. D.

30. Maturity Changes taking place in Refrigerated Pine Apples.

HENRICKSON, H. C. *The Journal of the Board of Agriculture of British Guiana*, Vol. XVI, No. 3, pp. 152-154. Demerara, 1923.

Report of observations made on pine-apple fruits after removal from the refrigerator. The changes in composition and colour according to variations in temperature were noted and the following deductions made: 1) A temperature of 50°-60°F will partly interfere with maturity changes. This applies also to fruit ripened on the plant which if not infected with fungi will keep for a week without change, although for longer it is not dependable. Green fruit will not change colour perceptibly; 2) A temperature of 35°-40°F. prevents changes very effectively whether the fruit is

either green or ripe. Green fruit will mature after removal from the refrigerator if kept there only for six days. If kept for a longer period a normal change does not occur either in colour or in composition of the juice ; 3) Pine-apples can therefore be precooled at a temperature as low as 35°F for a short period with satisfactory results. Well coloured fruit can be stored for a fairly long period at about 40°F.

Considerable shrinkage was noticed in fruit stored at 50°-60°F for three weeks but the change was negligible when kept at 35°-45°F. As regards methods of prevention of shrinkage : covering the fruit with melted paraffin was found to be successful. The fruit was smoother and firmer for a much longer period than when left-untreated. This method is, however, not recommended for green or bronze coloured fruit as the paraffin hinders colour changes, but is suitable for large sized plant-ripened fruit shipped under refrigeration. Such fruits are superior in quality to those picked before being coloured and there is every opportunity to build up a market, a practice hitherto neglected. M. L. Y.

Plant Breeding.

31. **Plant Breeding from the Standpoint of Utility.**

ZAVITZ, C. A. (Professor of Field Husbandry, Agricultural College, Guelph, Ont. *Scientific Agriculture*, Vol. IV, No. 4, pp. 113-116. Ottawa, 1923.

An account of the work of the Ontario Agricultural College as regards improvement of crop yields by selection and cross-fertilisation. The author mentions that a total of over 2500 varieties of farm crops have been grown under test to study their suitability for Ontario conditions, and about 50 000 hybrid plants have been grown annually and studied. Descriptions and details are given of O. A. C. varieties of peas, barley, oats, early oats, winter wheat, spring wheat, rye and millet. W. S. G.

32. **A New Wheat for South Sweden.**

AKERMAN, A. Svalöf Pansar III. Ny mycket hogt avkastande host-vetersort for Skane och agransande provinsen. *Sveriges Utsädeförenings*, Part 3, pp. 127-134. Svalöf, 1923.

One of the best wheats obtained at Svalöf is Pansar III, the result of a cross made by Prof. NILSSEN-EHLE between the wheat " Grenadier " which produces good grain, but is not sufficiently cold-resistant, and the " Kotte " variety that is resistant both to rust and frost. Owing to its great productivity (the yield is 10 to 15 % larger than the varieties grown previously), and its rust and cold resistance, Pansar should soon become the wheat chiefly cultivated in South Sweden.

The hybrids first put on the market showed a certain instability, as often occurs in the results of recent crosses.

In order to remedy this defect, NILSSON has made a new selection since 1912 with a view to obtaining greater fixity of characters, earlier maturity and shorter straw. The result was Pansar II, a wheat with

the same characters as Pansar I, but having slighter and shorter straw. Pansar II as placed on the market in 1919, and was soon grown throughout the whole of South Sweden.

The author however was still not satisfied, and in 1915, in order to produce better forms with higher yield and stiffer straw, he began a new series of selections. Three of the lines obtained (0804 — 0805 and 0806) were subjected to comparative cultural tests in 1918.

The best results both as regards yield and straw were given by 0806 which had very short, stiff haulms, thus comparing very favourably with Pansar II ; it was sold under the name of Pansar III.

Productivity. — The cultural comparative tests made at Svalöf, Bonkoping and Alnarp testified clearly to the undoubted superiority of Pansar III over Pansar II.

		Pansar III		Pansar II	
		Kg. grain per hectare	Relative number	Kg. grain per hectare	Relative number
		—	—	—	—
Svalöf	(1919-1922)	5 055	102.7	4 930	100.0
Dunkoping	(1920-1922)	6 100	106.1	5 740	100.0
Alnarp	(1920-1922)	5 400	108.5	5 030	100.0

Similar results were also obtained from comparative cultural experiments carried out in many parts of South Sweden in 1920, 1921 and 1922. Taking the production of Pansar II as 100, the general average of Pansar III was 181.8 in 1920, 103.6 in 1921 and 101.3 in 1922. Pansar also holds it own well if compared with Riddar.

	Pansar III		Riddar	
	Kg. grain per hectare	Relative number	Kg. grain per hectare	Relative number
	—	—	—	—
Alnarp (1920-1922)	5 400	103.7	5 150	100.0
Svalöf	5 055	98.8	5 070	100.0
District of Malmatrus 1921	5 260	107.2	4 910	100.0
District of Malmatrus 1922	3 740	103.9	3 620	100. 0

At Svalöf, and in places in general where early maturity is required, Riddar from its quick ripening coupled with its great weight per hectolitre may well retain its place beside Pansar III.

The following table gives the averages obtained with other varieties during a three years' series of cultural tests by Prof. Forsberg.

	Kg. grain per hectare	Relative number
	—	—
Pansar II	5 030	100
Fylgia	5 040	100
Riddar	5 220	104
Standard	5 320	106
Pansar III	5 400	107

Strength of straw : this is estimated according to a conventional scale of values ranging from 1-10.

The data obtained from field observations at Svalöf were as follows:

	1919	1920	1921	1922	Average
Extra Squarehead III.	6	9	7	5	6.8
Sol II.	5	6	5	1	4.3
Pansar II	6	8	7	5	6.5
Pansar III.	9	10	8	7	8.5
Riddar	6	9	8	4	6.8
Fylgia	5	7	4	1	4.3
Fys.	3	6	3	1	3.3

Owing to its high yield, stiff straw and resistance to rust, Pansar III has the right to maintain its place on the market. This wheat is especially to be recommended for the warmer grain soils of Skania, where hitherto Pansar II and Extra Squarehead have been cultivated. Pansar III could however be grown in other parts of South Sweden where the climate is similar to that of Skania, such as for instance, Stalland, Blekinge, Sudkalmar, Oland and Gottland.

In the other zones of Gottland, the new variety will only do well from the technical standpoint and ripen regularly in particularly favoured spots. As a rule, it is better to cultivate in these localities earlier and hardier varieties, such as Riddar, Sol II and Thule. C. P.

33. **Natural Crossing in Winter Wheat.**

GARBER, R. J. and QUEENSBURY, K. S. *Journal of the American Society of Agronomy*, Vol. XV, No. 12, pp. 508-512. Albany, N. Y., 1923.

Formerly it was believed that natural crossing in wheat seldom occurs, but evidence collected during the past few years shows such a belief was not well founded, as natural wheat hybrids have been observed in various countries by plant breeders. The occurrence of such hybridisation adds to the difficulty of maintaining pure lines.

The authors' object was to present evidence of natural crossing in winter wheat grown on the Agronomy Farm, West Virginia.

In the summer of 1921 over 3000 spike selections were made from 19 impure varieties of wheat, showing spike characteristics differing in awn development, outer glume colour and covering (pubescent or smooth), these three characters being used in detecting the F_1 plants and also in determining segregation. In all, there were 1461 pure line selections whose spikes were studied. All the plants thought to be first generation hybrids found in the 1461 selections grown in 1922 were again grown in 1923, a single spike of each F_1, plant being used to test its breeding characteristics. The results showed that eleven plants were not hybrids. Twelve of the progenies were killed or damaged by winter injury so that their breeding behaviour could not be ascertained.

The variety Mammoth Red produced 10 F_1 hybrids in 98 rows, whereas the variety China, produced none.

The earliest variety began heading about May 16 and the latest May 23, 1921. The data show that during this period there was only one day

on which rain fell and that was when the wheat had nearly finished blooming. There were 6 cloudy and 5 clear or partly clear days. The temperature fluctuated from minima of 38° and 62°F to maxima of 65° and 80°F. Relatively more F_2 hybrid plants were found among the earlier blooming varieties, which, for the most part bloomed during sunny days.

These investigations show that natural crossing occurs in winter wheat, and the evidence indicates that for the year 1921 and under the given conditions, there was less than one per cent. natural crossing. W. S. G.

34. Studies in the Genetics of Maize.

I. EYSTER, W. H. The intensity of Linkage between the Factors for Sugary Endosperm and for Tunicate Ears and the Relative Frequency of their Crossing over in Microspore and Megaspore Development. *Genetics*, Vol. 7, No. 6, pp. 597-601. Menasha, Wisconsin, 1922.

II. ZAPPAROLI T. V. La Stazione di Maiscoltura di Bergamo. *L'Italia agricola*. Year 60, No. 12. pp. 446-456. Piacenza, 1923.

I. The author describes the results obtained in the progenies of reciprocal back-crosses and data relative to the frequency of crossing over in microspore and megaspore development in maize(1). The linkage intensity

Crossing-over between Susu and Tutu as shown by the back crosses.

$$\frac{Sutu}{suTu} \times \frac{sutu}{sutu} \text{ and } \frac{sutu}{sutu} \times \frac{Sutu}{suTu}$$

Pedigree Numbers	F_1 ♀						
	Su Tu	Su tu	su Tu	su tu	Total	Crossovers	Crossovers %
660–13	27	65	53	24	169	31	30.18 ± 2
660–16	32	66	50	16	180	48	26.67 ± 2
661–2	25	62	52	29	168	54	32.14 ± 2.
663–6	60	117	97	25	299	85	28.45 ± 1
663–9	37	93	67	37	234	74	31.62 ± 2
Total	281	403	335	131	1,050	312	29.71 ±

(1) When two genes exist in the same chromosome, the tendency is naturally towards coupling of characters, known as linkage of factor-pairs. For example in case of linked genes *A* and *B* in the same chromosome *x*; all the gametes, both male and female will reproduce characters *A* and *B*. By crossing with another species, containing genes *a* and *b*, the F_1 hybrid may be represented by the formula *Aa Bb*. This hybrid, allowing for the linkage *AB*, *Ab*, *aB*, *ab*, should give only one type of gamete *AB* and *ab*. Back-crossing the hybrid of the first generation with the recessive character, gives

abAB = 1
abab = 1

between the factor pairs *Su su* and *Tu tu* (sugary endosperm and tunicate ears) was examined.

The F^1 plants constitute *Su su Tu tu* the frequency of crossing over being limited to the coupling of two ♂ factor pairs and two ♀ factor pairs. The author has utilised this cross $\frac{su\,Tu}{su\,tu}$ to obtain reciprocal back-crosses which represent a coupling series. Results are shown, in the Table. When the F_1 plants were used as seed parents the percentage of crossing over varied from 26.67 ± 2.28 to 32.14 ± 2.36. When the same F_1 plants were used as pollen parents, the percentage varied from 24.39 ± 1.96 to 41 63 ± 2.12. A summary of these data is given as follows :

	F_1 as ♀	F_2 as ♂
Non-cross-overs	738	1 389
Cross overs	312	546
Total	1 050	1 935
% Crossing over	29.7 ± 0.95	28.22 ± 0.98

Difference = 1.49 ± 1.36 ;.

F_1 ♂

Su tu	su Tu	su tu	Total	Crossovers	Crossovers %	Difference
312	269	94	778	197	25.32 ± 1.10	— 4.86 ± 2.59
163	148	42	234	123	28.32 ± 1.47	+ 1.67 ± 2.71
84	38	32	209	87	41.63 ± 2.12	+ 9.49 ± 3.17
97	93	48	268	78	29.10 ± 1.87	+ 0.67 ± 2.57
96	89	24	246	61	24.39 ± 1.95	— 7.23 ± 2.8
752	637	243	1,935	546	28.22 ± 0.98	— 1.49 ± 1.36

The hybrid will produce, as mentioned above, only two fomrs of gametes, *a* and *b* separated from the chromosome pair *A* and *B*, and each of these forming part of a distinct cellule.

Supposing then that the two chromosomes *AB* and *ab* are split up (whilst still adjacent or alongside each other in pairs) and that the two halves then reunite but change their position, the result will be two chromosomes *Ab* and *Ba*. This probability is the sole explanation of the "Crossing over" theory. It may be noted that the hybrid *Aa Bb* in addition to the gametes *AB* and *ab* produces a number of gametes *Ab* and *Bb* and the crossing over is even more marked. By recrossing the F_1 progeny (*AaBb*) with the

In megaspore development the average percentage of crossing over appears to proceed in an almost identical manner.

Conclusions : 1) A linkage exists between the factor pairs sugary endosperm (*Su*) and the tunicate character (*Tu*) in maize ; 2) Crossing over in both megaspore and microspore development occurs in approximately the same frequency ; 3) The average percentage of crossing over between these factor pairs was found to be 28.63 and 29.7 respectively.

II. IMPROVEMENT OF MAIZE VARIETIES AT THE BERGAMO EXPERIMENTAL STATION, ITALY. — Work was begun in November 1922 with four varieties. " Nostrano dell'Isola ", " Fignoletto d'oro, " Scagliolo " and " Rostrato, " and trials have since been made at Bergamo with some hundred varieties distributed over Italy, chiefly in the northern districts where the highest yields are obtainable. These are chiefly autumn and spring types, very few are white coloured and few are " cinquantine ". In addition the following varieties are under observation : one from Tripolitania, one from Somaliland, one from France, 5 from the United States, 12 from Argentina, etc.

In 1923, artificial self-pollination tests were made and some thirty types were eventually selected for further studies. The F_1 plants, were less vigorous, and distinct differences were observed in phenotypes etc., but the pure descendants were more uniform. The characteristic differences included : size, resistance to adverse conditions, abnormalities, etc.

Special attention is being given to early maturing varieties. This has been found associated with the position of the ears. In 1922, a sowing was made from non-self pollinated ears of " Nostrano dell'Isola ", taken from upper and lower portions of the culm respectively. The plants thus obtained were self-pollinated, and the resulting progeny from the lower portions were early maturing, but not well developed (only 30 % surviving) ; those from the upper portions were on the con-

parents *aa bb* (associated with only one form of gametes *ab*), the results are calculated thus :

$$ab \times AB = AaBb \ (1)$$
$$ab \times ab = aabb \ (2)$$
$$ab \times aB = aaBb \ (3)$$
$$ab \times Ab = aAbb \ (4)$$

Types 3 and 4 which contain only one of the two factors *A* and *B* (normally " linked ") are termed " cross-overs ".

MORGAN who first traced the crossing over with *Drosophila*, observes that this is only possible when two female gametes are produced. It appears therefore that four types of female gametes are produced *AB*, *ab*, *Ab*, *aB*, and only two male gametes, *AB* and *ab*. It is therefore advisable to employ the recessive *aabb* as male parent.

If the recessive be used as female parent the egg-cells in which the *ab* is fertilised in equal proportions by the spermatozoa *AB* and *ab* would give a progeny consisting as to one half, of individuals resembling the recessive parent, and as to the other, of individuals in the form of the hybrid F_1. TANAKA, when experimenting, with *Bombyx* observed on the other hand that " crossing over " occurs only in the formation of male gametes.

Recent experiments with hermaphrodite plants, the primula and maize, have shown that " crossing over " occurs in equal proportions with microspores and macrospores.

trary, well developed, in spite of the general loss of vigour as a consequence of self-pollination.

The variation in cob-formation, the blackening of the ear (protected by the short bracts), the imperfect grain, the tendency to sterility, etc., have all proved to be individual characters. G. A.

35. Improvement of the Rice Crop in Malaya.

I. — JACK, H. W. (Economic Botanist, Dept. of Agriculture, F. M. S. and S. S.) *The Malayan Agricultural Journal*, Vol. XI, Nos. 7-8-9, pp. 168-212. Kuala Lumpur, 1923.

II. — BIRKINSHAW, F. (Actg. Chief Agric. Inspector), Distribution of Selected Strains of Pure Padi. *Idem*, Vol. XI, No. 11, p. 335-343. 1923.

I. — Although 1700 so-called varieties of rice have been collected in Malaya, in reality there are probably not more than 300-400, and these can all be placed in one of the following groups, of which the Seraup and Radir types are the most important and include about 80 % of the total.

(*a*) Seraup type, has a distinct shoulder on the anterior extremity of the grain.

(*b*) Radin type, very uniform in outline, medium length.

(*d*) Rangoon type, broad and thick in proportion to its medium length.

Experiments were carried out to ascertain the relationship between yield per plant and tillering power and the results showed that strains having a high tillering power must be selected if increase in yield of grain is to be attained.

In Malaya, wet padi is almost entirely sown in a nursery and later transplanted into the fields, the spacing of seedlings in the final planting-out depending entirely on the nature of the soil, cultivation, and average depth of water.

As regards the best number of seedlings to plant together, it was found that the yield per "hill" and per acre shows a definite tendency to decline when more than three seedlings are planted per hill.

A test showed that light grains should be avoided when selecting seed.

Manuring is little practised in Malaya, although guano is used in Perlis, Kedah and parts of Perak ; the amount of phosphate in the guano varies from 6.3 % to 32 % and the quantity broadcasted every second year is from 600 to 800 lb. per acre. The thick growth of grass and weeds which springs up in the interval between the padi seasons is cut down and allowed to rot, or is ploughed into the wet soil, and is beneficial to the following crop. Various leguminous plants are being grown for green manures at the Krian Experimental Station.

The method of plant improvement by hybridisation and the isolation of elementary species has been applied to rice in the Krian dstricts of Perak where there is a continuous area of about 56 000 acres of irrigated rice land, in consequence of which the chief rice-breeding station was established at Titi Serong in this district. The importance of increasing the yield

will be realised from the fact that this district produces annually about 14 000 000 gantungs of padi (1 gantung of padi = 5.25 lb. approx.).

During 1915-1916, 300 strains of padi were selected from the heaviest producing districts and grown as pure lines, and at the next harvest 1000 more selections were added to these. All these strains were planted as pure lines, in triplicate, for two successive seasons, after which very many strains were discarded, until in 1922-23 only 77 strains representing five varieties were under trial. The author's data show that, giving due consideration to seasonal variations, a gradual increase of the mean yield per plant is apparent.

The following selections have been made for further trials in 1923-1924 and for distribution in 1924-1925: Seraup kechil Nos. 36, 52, 48, 68, 1; Radin puteh No. 13; Radin kuning No. 7; Radin merah Nos. 2 and 4; Seraup besar No. 15; Pahit No. 1. These have alrady been tested during the past two seasons at the Titi Serong Station in half-acre plots and also in other parts of the Peninsula.

A striking characteristic of nearly all the strains tested is the absence of empty grains on the ears, and the robust stand of the padi is another feature.

The data obtained show that the Seraup variety which requires 7-8 months to mature has a higher mean yield than the Radin type which matures in 6 months. The tillering curves are similar to the weight curves, Seraup being 20.5 tillers as against 19.0 for Radin. The Seraup varieties are better than the Radin for milling purposes, the former averaging 63 % of rice (by weight) and the latter 60 %.

The author expects that the use of selected pure strains will show increases varying from 5 to 25 %, according to local conditions and methods of cultivation.

II. — As a result of several years' work at the Titi Serong Rice Experiment Station, isolated pure strains of padi are in existance giving higher yields than unselected varieties in the country. Control of the distribution of these improved strains is necessary for the following reasons:—

(*a*) The cultivator's preference for the local varieties.

(*b*) The necessity to select a strain of a variety suitable for its environment.

(*c*) The necessity to guard against deterioration thorough admixture with unselected seed.

(*d*) The importance of recording yields from these strains and local varieties.

(*e*) To make comparative tests of pure strains in order to ascertain the most suitable strain for each locality, especially as padi is very susceptible to changes in environment.

The pure strains chosen when grown at Titi Serong, have given yields of from 20 % to 25 % higher than those of local varieties, but results cannot be judged from one or two years records, hence the need to control the subsequent distribution. At Kampong Lalang the average yield from

8 plots was over 730 gantungs per acre as compared with a yield of 575 from the best local variety.

In many instances the yields obtained from pure strain padis, even in the first trial, are such as to warrant the belief that they will be extensively planted after a few seasons. W. S. G.

36. The Standardisation of Rice in Cochin-China.

DEVRAIGNE, G. La sélection pour la standardisation des Paddys et des Riz. *Publication du Gouvernement de la Cochinchine*, 1 pamphlet, of 8 + 29 pp. Saigon, 1923.

A popular pamphlet setting forth the importance of the rice-cultivation question in Cochin-China and describing the means to be adopted by the Annamites for the improvement of the product with a view to its standardisation.

The cultivation of the improved varieties will only increase if a higher price is paid for the selected grain, and at present, the Chinese, who are the chief purchasers of rice, pay the same for all qualities. The state of affairs has, however, begun to improve, for out of the 11 140 tons of paddy that can be handled daily at Choloni (centre of rice preparation near Saigon), 4 500 now find their way to the factories managed by the French. Most of these firms buy paddys selected at the Government Station, and, on the production of the certificate of origin, pay a little more for this grain than for ordinary kinds of rice.

The Government of Cochin-China is having a Laboratory of Genetics built at Saigon ; it will be provided with an experiment field of 37 hectares.

At the present time, however, it is not a question of breeding pure lines, but of obtaining populations that answer trade requirements.

The pamphlet contains a list of the 14 commercial varieties of rice recognised by the Saigon Chamber of Commerce . By " sweepings " are to be understood portions of grains with a volume below 50 % of that of the whole grain. " Yellow grains " is the term applied to all seeds showing any trace of colour, the proportion of the latter must not exceed 2 % up to the end of July, and 3 % subsequently. R. D.

37. Inheritance of Growth Habit, Pod Colour and Flower Colour in Soybeans.

WOODWORTH C. M. (Associate Chief in Plant Breeding, Illinois Agricultural Experiment Station). *Journal of the American Society of Agronomy*. Vol. 15, No. 12, pp. 481-494 Albany, N. Y., 1923.

Two types of growth habit in soybeans are described, one a tall, luxuriant growing, late maturing type ; the other a low, compact, early maturing type. Genetically these two types behave as allelomorphic characters, the late maturing type being dominant. The genetic difference between them appears to be determined by a single pair *S*, *s*.

Dark-coloured and light-coloured pods constitute an allelomorphic

pair of characters, dark being dominant to light and differing from it by a single factor pair *L*, *l*.

Purple and white flower colours constitute a simple Mendelian pair of characters, purple being dominant. The factor *W*, *w* is proposed.

Perfect correlation exists between flower colour and stem colour; purple flowers always accompany dark stems, and white flowers green stems. W. S. G.

38. The Morgan Theory applied to Lathyrus.

PUNNETT, R. C. Linkage in Sweet Pea. *Journal of Genetics*, Vol. 13, No. 1, pp. 101-123, figs. 6, 1 Coloured plate. Cambridge, March 1923.

The author rejects the hypothesis of reduplication, and adopts Morgan's view respecting the haploid number of chromosomes and the number of groups of independent characters.

The present article describes the results of a series of researches on *Lathyrus odoratus* and also incorporates the data collected from 1904 until the present time.

The number of haploid chromosomes in *Lathyrus* is certainly seven, therefore according to Morgan's theory, there cannot be more than seven groups of independent characters. In the course of the investigations five different linkage groups were found and defined.

I. Group *A* (*a*): under this head are included three pairs of characters with their respective allelomorphs.

(1) *A* purple	a^1 red
(2) A^2 round pollen grains	a^2 elongated pollen grains.
(3) A^3 erect vexillum	a^3 hooked vexillum

The crossing-over percentage between A^1 and A^2 is only 1, which means that the two genes are nearly related and situated in the same chromosome at one unit of distance. The number of cross-overs between A^2 and A^3 is 12 %.

From the data at hand it would appear that A^1 is situated midway between A^2 and A^3.

II. GROUP *B* (*b*)

(1) B^1 dark axils	b^1 light axils
(2) B^2 fertile anthers	b^2 sterile anthers
(3) B^3 normal flowers	b^3 anomalous flowers.

The interval between B^2 and B^3 is probably 25 units, while B^1 is situated between B^2 and B^3, and lies at a distance of 6 units from the latter.

III. GROUP *D* (*d*) the type of *Lathyrus* known under the name of "acacia" is characterised by leaflets taking the place of the leaf-tendrils.

D^1 normal (with tendrils) — d^1 acacia type. The colour of the flowers is normally bright (purple and red), in some cases, corresponding to the recessive series, the colour becomes pale (blue, or reddish blue).

D^2 bright colour d^2 pale colour.

From 1910-20, a certain number of families obtained from a cross between " acacia " with bright coloured flowers ($d\ D^2$) and normal tendrils and blue flowers (D^1d^2), produced in the F_2 individuals having normally developed tendrils and brightly coloured flowers.

In the F_2 generation, four classes were obtained :

D^2 bright colour			d^2 pale colour.
" Tendril " with	bright coloured	flowers	847
» »	pale	»	298
" Acacia " »	bright coloured	flowers	300
» »	pale	»	49

The small number of " acacia " type with pale flowers being much lower than was expected suggests the possibility of linkage between " acacia " and the bright colour of the flowers. Reciprocal crosses were made between " tendril " with bright flowers and " acacia " with pale flowers. In F_1, as in the preceding case, there were " tendril " individuals with bright flowers, while in the F_2, the following groups appeared :

" Tendril " with	bright	flowers	424
» »	pale	»	99
" Acacia " with	bright	flowers.	102
» »	pale	»	91

Linkage therefore exists between brightness of colour and the " acacia " type — the percentage of cross-overs would be about 33.

III. Group F (f)

F_1 coloured flowers f_1 white flowers type R.

These white flowers had round pollen grains and belonged to the Emily Henderson variety. On crossing the white, round pollen-grain form of Emily Henderson with the white, elongated pollen-grain Emily Henderson type, some individuals with purple flowers were obtained ; this is said by the author to be due to the presence of the complementary factors C and R. By white of type R should be understood the white bearing the factor R, while white of type C contains the factor C.

F_2 = procumbent habit f_2 = bush habit

The first character is dominant.

F_3 = self-coloured f_3 = speckled.

The speckling is due to a white veining that interrupts the uniformity of the colour, so that we get speckled red, speckled purple, etc.

The relation between the white (type R) and the speckled characters respectively is very interesting ; the three tintings, self-coloured, speckled and white must be regarded as making a series of multiple allelomorphs.

Repeated crossing experiments have, in fact, shown that not more than *two* of these characters are ever present at the same time in any single individual.

The existence of linkage between white R and bush habit is equally clear.

In 1905, a cross was made between a bush form with white flowers and the common cupid form with procumbent habit and white flowers.

The F_1 generation produced individuals with purple flowers and long axes (tall). In the second generation, segregation according to the scheme foreseen took place, and cupid bush, as well as tall bush forms appeared, while 9 coloured flowered individuals were obtained for every 7 plants with white flowers. Other experiments have shown the factor, white R, to be present in the bush parent with white flowers and the factor, white C, in the other cupid parent. Thus the cross had been effected between $g_1 F_1 f_1$ (bush) and $G_1 f_1 F_2$ (cupid). The F_2 generation obtained consisted of three classes of individuals (for the pair $G\ g$ see later).

Coloured procumbent	130
» bush	53
White procumbent	89
» bush	24

More than a quarter of the coloured individuals were bushes, while the bush habit distinguished less than a quarter of the white individuals.

This distribution of habit was confirmed in the F_3 in which 4 families derived from heterozygous parents gave the following results for both colour factors.

		Coloured procumbent	Coloured bush	White procumbent	White bush
		—	—	—	—
1908	No. 133	83	57	101	17
»	» 135	161	70	141	30
»	» 139	66	26	42	9
»	» 159	57	21	60	9

Assuming linkage to exist between bush habit and white R, with 25 % of cross-overs, (repulsion in the ratio of 3 : 1 between F_2 and F_3 the 4 classes should occur in the proportion of 99 : 45 : 93 : 19. On combining the results of F_2 and F_3 we have :

	Coloured procumbent	Coloured bush	White procumbent	White bush
	—	—	—	—
Obtained	497	227	433	55
Calculated	485	218	447	92

These facts thus confirm the supposed linkage and the relative percentage of cross-overs.

Other investigations in progress have for their object the linkage relations between F_1, F_2 and F_3. For the moment, it can be assumed that F_1 and F_2 occupy the same locus, which is about 25 units distant from the locus of F_3.

IV Group.

G_1 Coloured flowers	g_1 white C flowers
G_2 Purple flowers	g_2 purplish red

In the same manner the existence of linkage has also been proved between two factors that would appear to be situated in the same chromosome at a distance of 25 units.

There are thus 5 linkage groups corresponding to 5 of the 7 haploid chromosomes.

We will now consider the other two. The three characters: *C* hairy (*c* smooth), E. tall (*e* cupid), *H* closed keel (*h* open keel), behave, as a rule, as if they were independent, that is to say, situated in three different chromosomes. The total number of chromosomes must therefore be eight.

The results of the author's experiments have revealed the possibility of linkage (though of an unstable character) in many cases. It would be sufficient to prove the existence, in a single one of these instances of linkage between two of the three factors under consideration in order for the number of independent groups to be reduced to seven pairs *i. e.* to the haploid number of the chromosomes of *Lathyrus odoratus*. G. A.

39. **Canna Crosses.**

HONING, J. A. *Mededeelingen van de Landbouwhoogeschool en de daaraan verbonden instituten*, Vol. 26, No. 2, pp. 1-56, with 11 figures and 8 plates (4 coloured ones). Wageningen (Holland), 1923.

The F_1 offspring of the cross *Canna glauca* × *indica* segregates for the factors of the red leaf margin, for the layer of wax on the leaves, the number and colour of staminodes in ratios that differ widely in different sowings, in spite of the fact that the F_1 consists of a single individual; so there is variability in segregation of the hybrid.

The factor *A* causes red flower colour, *aa* plants have yellow flowers. *B* produces together with *A* the broad red leaf margin. The factor *C* necessary in crosses of *C. indica* with its own green leaves variety as third factor for broad red leaf edges (plants containing *C* but without *A* and *B* both together, showed a very narrow red leaf margin) seems to be absent or totally prevented from showing in the cross with *glauca*. In some F_2 sowings the inheritance of *A* and *B* proceeds on ordinary Mendelian lines (9 : 7 ratio), in three batches the ratio is 1 : 1. In F_3 the 1 : 1 ratio appeared again, but also 9 : 7 and 3 : 1.

D, *E* and *F* are intensification factors for the red colour factor *A* and also for *R*, the factor for patched staminodes. One of the intensifiers *E* is coupled to a high degree with *B*. From the back cross of F_3 10-3 with *glauca* resulted that the *glauca* used for the back cross *J*-4-2-3 was heterozygous for *D*; *G* is an intensification factor for anthocyanin in the leaves. That F_1 has much redder leaves than *indica* depends on the factor *G*, cryptomeric in *glauca* and coupled with a factor for wax.

K and *L* are polymeric factors for the wax layer on the leaves of *glauca*. Judging from the thickness of the wax layer, *glauca* should be heterozygous for both factors. The back cross of F_1 by *glauca* however suggests homozygosity of at least one of both.

M, *N* and *O* may be three polymeric factors for the third staminodes, which becomes probable from the ratios in F_2, but far from certain, on account of the result of the back cross of F_1 with *indica*.

Q is a lethal factor in *glauca* × F_3 10-3, absolutely coupled with *A*

killing all *AA* plants in the offspring after selfing that hybrid. Probably it is the same factor that in *glauca* is coupled with *R* and being homozygous kills all *RR* plants.

H and *I* are the factors that constitute together the difference between the deep yellow chromatophores in the staminodes of *indica* and the pale yellow ones in those of *glauca*.

J is a factor for deeper vein colouring in most red flowered hybrids, almost invisible in the deep reds, clearly visible in the pale ones. Perhaps the central red colouring in a yellow margin is caused by the same factor *J*. *C. glauca* should be *Ji*.

P is an intensification factor for the central colouring. *PP* and *Pp* plants have much narrower yellow staminode margin. In *glauca* *P* should be present heterozygously.

R causes homozygous red patches in yellow flowers spread over the whole breadth of the staminode and heterozygous such spots in the middle of the staminode only. For this factor *R glauca* is a constant heterozygote owing to the presence of the lethal factor *Q*.

So far as we can judge now, doubtful factors being put in brackets, and marked with a point when homo or heterozygosis is unknown. *C. indica* will be:

AABB (*CC*) *DD* (*FFggHHIIjjkkll* (*mmnnoo*) *ppqqrr* and *glauca*:

aabb (*cc*) *DdeeffG.hhiiJjKkL.* (*M.N.O.*) *PpQqRr.*

It is not certain whether the variability of segregation is caused by irregular distribution of the chromosomes whether or not followed by differential fertilisation or differential mortality of gametes or differential mortality of zygotes. Shortly the authors hope to be able to give some cytological information.

As a rule F_4 and F_5 are more regular in their segregation than the F_3; clean cut Mendelian ratios reappear.

It has not been possible to work out a factorial analysis for leaf length and breadth, staminode length and breadth, form, size and colour of the seeds.

Measuring all leaves of F_1 and separate F_2 specimens and adding the figures for each plant separately, gives curves irregular on the minus side where the limits of variation are extremely wide. For F_2 as a whole this irregularity has vanished and the F_2 standard deviation for leaf length is even smaller than that of the F_1 which is one single individual. The staminode length is far less dependent on the position on the floral axis than the leaf length is dependent on the position on the stem.

D. v. S.

CROPS IN TEMPERATE AND TROPICAL COUNTRIES

Cereals

40. Production and Development of Cereal Crops (Excluding Wheat and Maize) in the United States.

BALL, G. R., STANTON, T. R., HARLAN, H. V., LEIGHTY, C. E., CHAMBLISS C. and DILMAN, A. C. (Bureau of Plant Industry), and STINE, O. C., BAKER, O. E. JUVE, O. A. and SPILLMAN, W. J. (Bureau of Agricultural Economics), Oats, Barley, Rye, Rice, Grain Sorghums, Seed Flax and Buckwheat. *United States Department of Agriculture, Year Book* 1922, pp. 469-568, figs. 64, Washington, 1923.

A survey is made of the world production, relative importance, trade, development and production in the United States, factors influencing yield, (including soil, climate, diseases and pests, special economic factors), problems of marketing quality, uses and experts of the following crops: — oats, barley-rye ; sorghum, seed flax and buckwheat (1). Damage to agricultural products, chiefly grain crops has been estimated at more than $150 000 000 per annum and $200 000 000 in storage and transit, due to rats, etc. The following facts are of special interest:

Oats : — The production it is estimated has reached the culminating point in the State, owing to the reduction in horse labour and the consequent decrease in the commercial demand for oats. Graphs indicate the rise and fall in acreage, yield and cost of production, 1866-1922 ; a decrease of 3 656 000 acres since 1918 is shown. The hot, dry weather during the ripening period caused much damage in the maize belt. The estimated annual loss due to disease, 1919-1921 inclusive, is shown in table I.

With the exception of occasional attacks of the green bug (2) very little damage is done by insects.

A reference is made to the marketing classification and grades, followed by a discussion as to the actual food value of oats, when ground or rolled.

Barley: — Since 1910 the average production has remained stationary, subject to certain fluctuations due to war conditions ; the yield is estimated at 25 bushels per acre ; the foreign demand is however on the increase, and balances the effect of the prohibition laws in the States and the decrease in demand for the malt houses. It appears probable that barley will cover a wider area in the future and the limitation to certain special areas will be discontinued ; various changes in location are possible, bearing in mind the importance of well-drained areas an cool summers. Districts suitable for late sowing, etc., are selected owing to quick maturity, and hence the value of the Dakota crops.

The actual losses, from diseases and pests are shown in Table I, at pre-

(1) For wheat and maize see Yearbook 1921. (*Author's note*)

(2) *Toxoptera graminum.* (*Ed.*)

TABLE I

	Oats			Barley			Rye		
	1919 bus.	1920 bus.	1921 bus.	1919 bus.	1920 bus.	1921 bus.	1919 bus.	1920 bus.	1921 bus.
Smut	39,238,000	40,143,000	35,810,000	3,237,000	3,377,000	1,458,000	not estimated	92,000	60,000
Stem rust	15,027,000	14,783,000	16,223,000	4,368,000	3,628,000	1,704,000	31,000	902,000	98,000
Crown rust	15,167,000	6,785,000	21,874,000	—	—	—	—	—	—
Leaf rust	—	—	—	negligible	242,000	negligible	538,000	25,000	112,000
Stripe	—	—	—	1,898,000	786,000	1,041,000	—	—	—
Scab	—	—	—	—	—	—	39,000	not estimated	not estimated
Ergot	—	—	—	—	—	—	not estimated	214,000	203,000
Various	8,915,000	16,488,000	25,252,000	942,000	1,714,000	5,021,000	964,000	173,000	357,000
Total loss	**78,347,000**	**78,199,000**	**99,159,000**	**10,445,000**	**9,747,000**	**9,224,000**	**1,572,000**	**1,406,000**	**830,000**

sent the barley area is outside the habitant of the destructive Hossian fly (*Cecidomyia destructor*) hitherto so prevalent in the North Eastern States.

There are no federal grades in the market, the accompanying graph indicates the annual variations on the Chicago and Minnesota markets. The approved value for brewing feeding and pearling is discussed and the 90 to 95 % value as a food for fattening live stock ; it is advised to crush or roll for all young stock as the flour is less suitable for mastication. It is the practice to fatten cattle for shows with this food, but a supplement of protein, concentrate or roughage is recommended ; for young pigs it should not be the only grain in a heavy ration, as the hulls may irritate the digestive system. The advantage of this system in preference to maize tank age is shown in the graph based on the results of experiments made at the Colorado Agricultural Experiment Station (1).

Rye :— During the 1910-14 period the United States produced about 2 % of the total rye crop of the world and since then there has been a gradual increase. About 96 % of the rye crop was produced and consumed in Europe. The report shows the fluctuations in acreage, yield, production and trade since 1867 ; the development from 1839 to 1919 is shown in the accompanying maps. Production is at present centred largely in the north-central States, has decreased considerably in the north-eastern areas, and has made little progress in the extreme west. The general factors influencing the yield are mentioned and the value as a winter cover crop with legumes as green manure and its importance as a hardy crop in areas unsuited to wheat. The loss from diseases is shown in Table I ; the damage for insects is negligible.

The production and exports have increased considerably in recent years, with certain fluctuations in 1920-21, the output in these two years being 60 490 000 and 57 918 000 bus respectively, and the exports 4 733 466 and 29 903 602 bus. Grades have not been fixed by the U. S. Department of Agriculture. In connection with the composition and food value of rye, the difficulties in mastication as a stock feed are mentioned ; it is advised that rye should be ground before feeding, especially for pigs and a protein supplement is important. Experiments at the Ohio Agricultural Experiment Station demonstrate this fact (2).

Rice :— In addition to the general survey referred to at the beginning, the report includes an interesting statement concerning the world production and international trade of rice and the wholesale prices of cleaned rice and the farm price of paddy, the average production, consumption, export and import for 5 year periods 1821-1921. A short survey is made of the principal physical factors affecting production, irrigation, moisture, soil, of the diseases and pests, and of the utilisation of the by-products.

Grain Sorghums:— The great importance of the sorghums in the Southern sections of the Great Plains area is described, the utilisation as feed and roughage for stock and the silage value :— maize is unsuited to these areas of insufficient rainfall and drying winds. The average acreage

(1) See *Bulletin* 165 *Colorado Experiment Station.* (*Author's note*)
(2) See *Bulletin* 268 *Ohio Agricultural Experiment Station.* (*Author's note*).

in 1922 is given as 5 millions and yield per acre, 17.9 bushels; total production 90.381.000 bus., value 87.6 cents per bus. The sorghums are becoming very important as a stock feed in the South West ; the value of kafir + alfalfa and milo + alfalfa for fattening hogs compared with maize + alfalfa is shown by the results abtained at the Kansas Agricultural Experimental Station (1).

The feeding value is equal to about 80-90 % that of maize. Investigations are being made as to the value of the grains for alcohol production.

Seed Flax :— The area estimated in 1922 was 1 308 000 acres with a production of 12 238 000 bushels, grown on the hard red spring wheat areas in Dakota, Minnesota, and Montana which produce 95 % of the total crop. It is generally grown on new land or after a grass crop or following a cultivated crop where weeds have been eliminated, as flax does not compete well with weeds : it is advised that it should be grown in rotation with clover, timothy or maize ; success has been obtained on ploughed pasture lands. In referring to the diseases, it is stated that a number of fairly satisfactory wilt resistant varieties are now available, as wilt disease has caused much damage on old flax land. The grasshoppers which frequent the flax areas are controlled by a poison bait of wheat bran. The principal markets and crushing centres are mentioned and the recognised grades. The linseed oil value is quoted at 2 ½ gallons of oil per bushel of flaxseed, i. e. the seed contains 30 to 40 % oil.

Buckwheat :— Although this crop is not considered likely to attain any greater importance in the States, there is a definite and steady demand for the grain and its products in the areas where it is now grown. It is suited to new land and land just cleared from timber or on drained marshland, This crop assists in making hard land friable and consequently is useful in the preparation of land for such crops as potatoes is noted. Although suitable for to poor soils, the climatic requirements are more limited, as the plant is not resistant to low temperatures :— diseases and pests are not reported. Apart from the value for milling purposes, buckwheat is not recommended as a stock feed, but this depends on the percentage of hulls. Grinding and crushing is essential for all classes of live stock.

Costs of production.

Apart from the difference in seed cost and those factors affected by variations in yield, oats, barley and rye all require the same machinery and similar methods of cultivation. Comparison of the three crops indicates that, for example, in Minnesota 87 % of the barley, 75 % oats and 50 % rye were produced on ploughed land, but that the hours of labour previous to harvest were 4.7 for barley and only 2.8 hours for rye. It has been taken as a general average that the total cost per acre in the average, is lowest for rye and highest for barley in any given region.

Rice :— In an investigation made in 1920 as to the cost of production of rice in Texas, Louisiana and Arkansas, the following averages were

(1) *Bulletin 198 Kansas Experiment Station.*

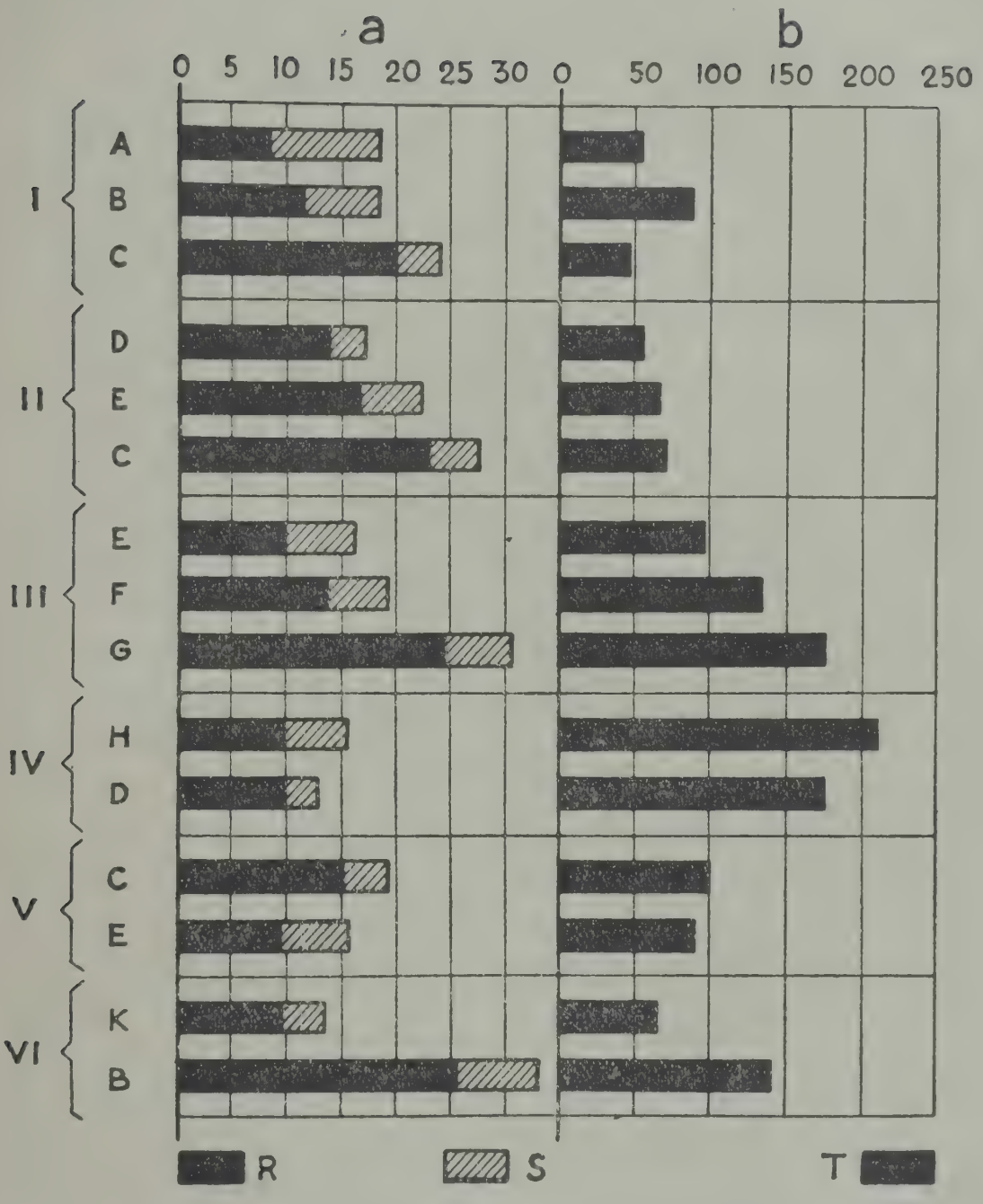

FIG. 1. — Regional Variation in Cost of Production.

a = dollars per acre; b = cents per bushel.

I = oats; II = barley; III = rye; IV = flax; V = buckwheat; VI = milo and kafir.

A = Illinois; B = Kansas; C = New York; D = N. Dakota; E = Wisconsin; F = Ohio; G = New Jersey; H = Minnesota; K = Texas.

R = operating costs; S = use of land; T = Total cost per bushel.

TABLE II.

Item of cost	Average costs for 1922				Your farm 1922				Your farm 1923			
	Unit	Amount used	Rates used	Cost per acre	Amount	Price	Cost	Amount	Amount	Price	Cost	Amount
			cents	dollars								
Man labour												
Before harvest	Hrs.	6	25.0	1.50								
During harvest and after	Hrs.	9	25.0	2.25								
Horse labour	Hrs.	24	15.0	3.60								
Seed	Bus.	2.2	60.0	1.32								
Twine	lb.	2.5	14.0	0.35								
Coal	lb.	48.0	0.5	0.24								
Total labour and material cost (70% of total)	...	...	...	9.20	...	...	...	...				
Total operating cost (100%)				13.23								
Interest on land (5% on $90 per acre)				4.50								
Total cost				17.23								
Value of straw (0.8 ton at $5)				4.00								
Net cost per acre				13.73								
Cost per bushel (yield 40 bus.)				0.34								

given :— Number of farms 92 ; Cost per acre :— labour $20.34 ; horses 12.16 ; tractors 7.60 ; materials (included cost of fertilisers, seed, twine and sacks), 11.88 ; threshing 2.31 ; cost of water bought 1.55 ; farm pumped water 14.24 ; miscellaneous 10.68 ; use of land 9.62. Total $90.38.

Sorghums :— The costs vary with differences in manure and labour requirements ; hence the varying records from Texas and Kansas (see Fig. 1).

Flax : — Similar variations occur according to methods adopted in seed preparation, harvesting, etc. (see Fig. 1).

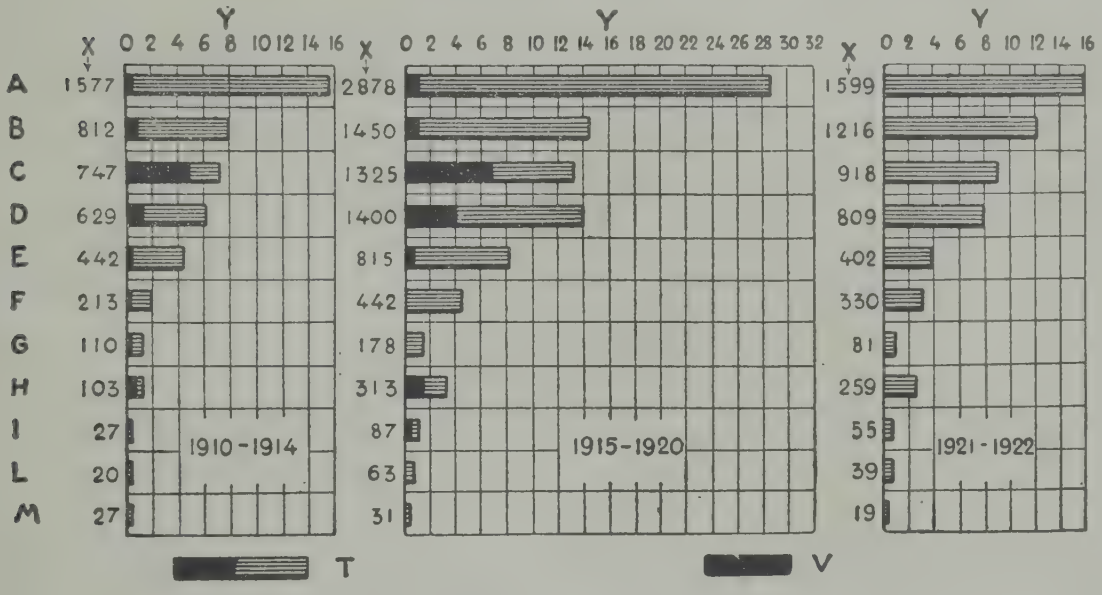

FIG. 2. — Comparative Value of 11 farm crops in the United States.

X = Value in dollars (millions).

Y = Dollars (hundreds of millions).

A = Maize ; B = hay ; C = cotton ; D = wheat ; E = oats ; F = potatoes ; G = barley; H = tobacco ; I = rye ; L = rice ; M = flax.

T = Total Production ; V = Exports.

Buckwheat :— The estimate is placed at about 12 hours manual labour and 28 horse-hours (records in Pennsylvania and New York, the chief crop area). Other costs — machinery, threshing, etc. $2 to $2.50 per acre.

An interesting method commonly used for computations of cost is described in detail and the example shown in Table II is given, based on the estimated cost of producing oats in Wisconsin in 1922.

A detailed chart shows the relative position of the four great staple crops, maize, wheat, hay and cotton and the seven crops here reported, and the distribution in the States. The appendix includes world statistics concerning area and production 1922.

M. L. Y.

41. The Effect of Early-Seeding on Crop Yield.

HOPKINS, E. S. *Report of the Dominion Field Husbandman*, Central Experiment Farm, Ottawa for the Year 1922, pp. 4-7. Ottawa, 1923.

The author draws attention to the importance of early seeding and its effect on the crop yield. The following table gives the yields from four crops seeded at six different times in the spring; the experiments were carried out at Ottawa, continuing for ten years with wheat, oats and barley and five years with peas. The first seeding was made as soon as the land was ready in the spring, and the five other seedings were made at one-week intervals.

Influence of Date of Seeding on Yield of Grain.

	Oats	Barley	Spring Wheat	Peas
	bushels	bushels	bushels	bushels
First sowing	53.3	38.4	17.9	30.4
Second sowing	59.5	44.2	20,5	33.9
Third sowing	50.7	33.5	14.1	32.8
Fourth sowing	45.9	31.5	12.2	29.9
Fifth sowing	40.2	26.1	10.3	26.3
Sixth sowing	31.9	23.7	8.6	23.8

The second seeding, which was made seven days after the land was ready, gave the highest yield in every instance, but the land at the Experimental Farm is drained, and perhaps on many farms the earliest seeding would give the maximum yield; in any case, the results show the advantage of early seeding. W. S. G.

42. The Yield of Wheat in England during Seven Centuries.

WHITNEY, MILTON (Bureau of Soils, Washington, D. C.). *Science*, Vol. LVIII, No. 1504, pp. 320-324. Lancaster, Pa., 1923.

The author discusses the various explanations which have been made relative to the increase of yield of wheat in England, which averaged about 6 ½ bushels per acre from the thirteenth century until about the year 1550 and then rose steadily to the 32 bushel yield of the present day.

The most important factors for improvement dealt with are: — the inclosure of field farms in the sixteenth and seventeenth centuries, the introduction of clovers, alfalfa and roots and the increase of stock; improved methods of agriculture and the use of fertilisers.

Allusion is made to the average yield of wheat in the United States, which, during the past 40-50 years has advanced from 12 to about 15 bushels per acre.

It is considered that the low average yield in medieval times must be ascribed to the methods, to the system, rather than to any loss of plant food on the farm and that the increased production of England to-

day is due to the methods, system and higher average intelligence of the man who works the soil. KING, in his study of Chinese agriculture estimated that the yield of wheat on a field of a Chinese farmer was no less than 117 bushels per acre.

The author doubts whether such a yield could be obtained under the general economic conditions of the world, but he does not consider that the limit of possible production of the average farmer in England has yet been reached. W. S. G.

43. **Wheat Cultivation in the Congo.**

PYNAERT L. La culture du froment au Congo. *Bulletin de l'Association des Planteurs*, Vol. 10, Nos. 11 and 12, pp. 208-209. Antwerp, 1923.

Wheat, which was doubtless introduced by the Arabs, is regularly sown on the European farms of the high plateaux region in the Congo, and is also cultivated by the natives The grain is used in the European centres and a certain amount is exported by way of Dar-es-Salaam. R. D.

44. **Amount of Seed to be Used in Comparative Wheat-Growing Experiments.**

DRAGHETTI A. (R. Stazione Agraria Forlì). *L'Italia Agricola*, Year 60, No. II, pp. 430-433. Piacenza, 1923.

In order to obtain accurate results from comparative trials of varieties of wheat, it is necessary to sow an equal number of viable seeds instead of using equal weights of seed per surface unit as is generally done.

Equal weights of grain contain very different numbers of seed ranging from 15 to 16 thousand or less, to 20 to 30 thousand, or more, per kilogramme. The weight of the caryopsides of the same race varies according to the year. The author obtained the following figures from 1000 caryopsides dried at 105°C. Carosello Fam. 91: in 1919, 52.42 gm., in 1920, 47.22 gm., in 1921, 43.72 gm.; these figures corresponded respectively to: 18.3, 19.1, 22.9 thousand grains per kilogramme. In the same years, Carlotta Strampelli produced 16.9; 20.6; 6.5 thousand caryopsides per kilogramme.

In determining the amount of seed to be used its real value V must be taken into account. This is given by the well-known formula $V = \frac{G\,P}{100}$, where G represents the viability percentage and P the purity percentage.

The best thickness for the seedlings, as found by various students of the subject (JOULIE, PIERRE, OPPERMANN and DE GASPARIN), is about 300 ears per square metre, that is to say, about 100 plants per square metre in the case of common varieties grown in Italy.

The number of seeds planted must, however, be a little more than double, for only under favourable conditions does each seed produce a plant. The losses estimated by PIERRE were 64 %, by OPPERMANN 55 %, while the author obtained an average loss of 59 %, the maximum and minimum

losses being respectively 66.9 % and 38.2 %. In another series of tests, however, where the soil conditions were better and much care was given to the crop, the average, maximum and minimum losses were reduced to 42.2 %, 48.4 % and 35.8 %.

The average tillering observed by the author in 1920, in the case of soft wheats was 4.2 ears per plant with a minimum of 3.2 and a maximum of 6.7.

Taking P as the weight of 100 caryopsides K as the coefficient of survival (which represents the proportion between the seeds sown and those producing plants and depends upon the conditions obtaining at the time of sowing), and V as the real value of the seed, we obtain the following formula giving the weight of seed per square metre corresponding to equal numbers of viable seeds for different plots of wheat — $\frac{PK}{V}$ and in kg. per hectare, 10 $\frac{PK}{V}$.

The value of K in the case of seed sown broad-cast and covered over with the hoe is 2.38 in the majority of cases, while when the seed is drilled, its value may fall to 2; it is always highest when seeding has been done under adverse conditions, as for instance in late sowings.

Where $K = 2.38$ the author found that the amounts of seed necessary to produce 100 plants per square metre were as follows: Rieti fam. II, 168.2 kg. per hectare; Gentil Rosso, fam. 48,133.8 kg.; Colegna, fam. 20, 151.7 kg.; Luigia Strampelli, 95.6 kg.; Ardito, 91.3 kg.; Riccio, 74.0 kg. F. D.

45. Weeding Wheat.

MORETTINI, A. (Sezione professionale di Casalina del R. Istituto Superiore Agrario Sperimentale di Perugia). Le Sarchiature nella coltura del frumento e le piante infeste. *L'Italia agricola*, Year 60, No. 10, pp. 379-388. figs. 5. Piacenza, 1923.

The most practical cultural measures to be adopted with a view to freeing wheat fields from weeds are as follows: 1) chemical methods of control, of which the most effective is a solution of *sulphuric acid* (1); 2) harrowing and scarifying; 3) weeding.

1) The author carried out comparative tests on wheat seed-beds in February and March; he found that sulphuric acid is effective where the wheat is broad-casted, but hoeing is more satisfactory when the wheat is drilled.

2) From comparative tests conducted on harrowed and unharrowed plots for two consecutive years, the author discovered that though harrowing was beneficial to the wheat, it only uprooted the weeds which had lately germinated with the result that the number of weeds present on the two sets of plots was about equal.

(1) See *R.* 1916, No. 128. (*Ed.*)

FIG. 1. - - The Morettini Wheat Weeder.

FIG. 2. — Means of rapid drying of hay.
Frame with ventilator fixture.

Scarifying is usually done later (in April-May) viz. at the period when weeds are mature ; it certainly prevents the weeds bearing seed, but his time they have done most of the damage of which they are capable, further, it is a very expensive operation.

3) Weeding is the best, and perhaps the only satisfactory means of troying infesting weeds, but if hand-weeding is necessary so much our is entailed that the return is not equal to the expense.

The author has therefore devised a cheap weeder that can be made the farm and executes the work quickly and at little cost. This weeder shown in fig. 1. It is provided with bars and consists of an iron frame, the front portion of which are attched small triangular shares that stir e superficial layer of soil and cut down the weeds. The rear portion of he frame bears little wings for moulding up. The depth is regulated by eans of a screw that unites a cross-beam fixed to the bars, with a fixed ver instead of with the bar carrying the shares. The screw can be adjusted even when the apparatus is in motion. This weeder is drawn by a ingle animal (ox or horse), and the damage caused by trampling is reduced to a minimum.

In order to be able to use this animal-drawn weeder, the wheat was not sown in equidistant rows, but in pairs leaving, for instance, 9 or 10 cm. between the two rows, and 35 to 40 cm. between the pairs. The blade of the weeder works over 22 to 28 cm., so there is no fear of its cutting the wheat seedlings. With this implement 2 to 2.5 hectares can be weeded and moulded up in 8 hours.

The best distance between the rows and the pairs of rows, naturally depends upon local conditions and must be experimentally tested in every case.

In two consecutive years, the author compared : broadcasting followed by hoeing and scarifying ; sowing by spring weeding ; sowing in paired rows at alternating intervals of 10, and 40 cm., followed by three weedings. He obtained respectively, 16.59-19.25-20.3 quintals of grain per hectare and 88.6-79.2-84.7 quintals per hectare of straw and chaff.

Later, he studied the effect of the number and the time of the weeding operations on the crop and also on the weeds. To this end, he carried out the following operations on 4 pairs of plots : I) one weeding ; II) two weedings ; III) three weedings ; IV) no weeding (control).

The average number of weeds present at the beginning of May in the various pairs of plots was respectively 141—64—32—217 per sq. metre ; the average tillering (number of culms per plant), at the same date was 2.40—2.93—2.90—2.79 ; while the grain yield per hectare was 30.81—30.97—31.56—29.50 quintals (Varrone wheat following maize). Thus the number of weeds eliminated, the tillering and the yield are proportionate to the number of weedings.

Similar results were obtained next year with the same variety of wheat which followed a beet-crop. In these experiments, the average yield of two plots, that had been weeded late and only once, was 27.70 quintals per hectare as against 23.99—26.40, and 27.17 respectively from the plots which had received 1 — 2 — 3 weedings. The yield of the con-

53. **Uses of Various Kinds of Lupin.**

GUILLIAUME. Les lupins horticoles et de grande culture Leurs emplois. *Revue de Botanique appliquée et d'Agriculture coloniale*. Year 3. No. 27. pp. 758-770. Paris, 123.

An account of what is at present known respecting the different kinds of lupins: their history and classification, cultivation, chemical composition (principal constituents, toxicity), use in agriculture and as a food for man. R. D.

Starch Plant.

54. **The Sweet Potato *(Ipomoea batatas)*.**

BROOKS, G. B. (Instructor in Agriculture). *Queensland Agricultural Journal*. Vol. XX, Pt. 2, pp. 124-148. Plates 15. Brisbane, 1923.

A comprehensive description of the origin of the sweet potato, distinction between vernacular names, propagation, classification according to distinguishing characters. In addition to the collection and classification of existing varieties the raising of new varieties in Australia from seed is described.

A table of analyses of varieties is included together with coloured illustrations of the leaf and tuber (whole and cross sections) of 47 types. M. L. Y.

Forage crops.

55. **Plant Succession in South African Grassland and the Need for Maintaining a Covering of Vegetation.**

POTTS, G. (Professor of Botany Grey University College, Bloemfontein). *The South African Journal of Science*. Vol. XX. No. 1, pp. 196-101, bibliography. Johannesburg, 1923.

Drought alone is sufficiently severe to kill off native vegetation, and frequently followed as it is by heavy thunder rains, this encourages subsequent soil erosion and the inevitable consequences. The author, however, emphasises the fact that these troubles are greatly accentuated by veld burning and heavy grazing, by removal of trees, and by utilisation of mountain districts for agricultural purposes, for which man is entirely responsible.

Deterioration of grazing areas in the Orange Free State (South Africa) is very marked in the central districts subject to drought. Here the natural vegetation consists chiefly of *Andropogon iudicus* Retz. If the veld is denuded, the re-establishment of *Andropogon* grassland is a slow process and natural development or plant succession consists first of a sparse covering of flowering herbs and weeds, gradually replaced by short grasses, such as *Tragus kalaroides* Aschers. *Aristida*, *Eragrostis* and *Sporobolus*, and then finally by the "climax" original type of *Andropogon*. For further particulars of the succession followed, reference is made to the compo-

hensive work of Prof. J. M. Bews "*The grasses and grasslands of South Africa*".

It has been observed that the original *Anthistiria* areas are not subject to erosion under normal conditions, but if this tall grass veld suffer from drought, heavy grazing or burning, deterioration of soil invariably follows. It is a recognised fact that burning of natural vegetation is often essential to maintain a grass palatable to stock. An example is given of the eastern districts of the Orange Free State where the natural growth consists of tall coarse grass (*Andropogon* and *Cymbogon*), distasteful to stock, and which consequently necessitates periodical burning. From the economic standpoint, however, the resulting waste of large areas through soil erosion due to lack of protective covering needs practical consideration. The author discusses the possible means of controlling these processes; erosion, restoration of the level of under ground water, re-establishment of springs by the development of natural vegetation, and the replacement of muddy floods by streams of clear water. An experiment is suggested also for afforestation from the point of view of regulating erosion and underground water and the effect on rainfall, quite apart from the timber value. A similar test is in progress in Colorado under the direction of the United States Department of Agriculture.

Fenced plots, neither burnt nor grazed, would indicate the extent to which these factors are responsible for veld-deterioration and would serve also as a source of seed for the original "climax" native vegetation.

M. L. Y.

56. **A Chemical Study of Legumes and other Forage Crops of Western Oregon.**

Jones, J. S. and Bullis, D. E. *Oregon Agricultural Experiment Station, Dept. of Agricultural Chemistry, Station Bulletin* 197, pp. 1-24, tables V. Corvallis, Oregon, 1923.

A full description of all the common forage crops grown in Western Oregon (U.S.), studied from the chemical standpoint, relative to nutrition. The Tables give details as to percentage composition, carbohydrate value, mineral constituents and average weight of nutrients of the crops.

M. L. Y.

57. **Alexandrian Clover.**

Villaescusa M. H. El trébol alejandrino (1) *El Cultivador moderno*, Year XIII, No. 7, pp. 8-9. Barcelona, 1923.

The author treats of Alexandrian clover (*Trifolium alexandrinum*), from the points of view of a plant for green-manuring and for forage; he mentions cases in which it has been grown in association with non-irrigated herbaceous, or arborescent, crops and also with irrigated crops.

J. P. C.

(1) See *R.* 1922, Nos. 37, 75, 535 and *R.* 1923, N. 646. (*Ed.*)

58. Artificial Harvesting.

Some Details of a Successful Preliminary Investigation. *The Implement and Machinery Review*, Vol. 49, No. 583, pp. 783-786, figs. 3. London, 1923

The Technical Service of the British Ministry of Agriculture has begun some preliminary experiments in drying cereals and forage by artificial means. The experiments were carried out on grass, clover, wheat, barley, oats and peas; they were successful in every case except that of grass.

The crop after cutting was piled up while still green around a central wooden frame connected by a pipe with a bellows situated on the outside of the heap. The bellows reduce the temperature of the mass and help to expel the excess moisture. The action of the bellows was more or less intense, continual, or intermittent, according to the case and the degree of the heating of the mass.

The operation was carried out most easily with the cereals. A crop of barley that had been considered lost owing to the heavy rain to which it had been exposed was treated while still very damp and was saved by all the moisture being removed. The peas artificially dried fetched the highest price on the market, while the haulms were preserved in excellent condition.

Although simple drying is all that is required by cereals, it is not sufficient, for forage, which when piled up in heaps speedily reaches a temperature of 50° C., when the removal of too much moisture may interfere with the proper progress of fermentation. It would appear to be necessary to blow in air as soon as the heap is made, in order to remove the surface moisture (this introduction of air should probably be continued for two or three days), after which, a current of air ought to be sent through to remove the water of saturation, and the temperature of the forage must be kept near 50° C (the optimium temperature for fermentation) by blowing in air several times.

One of the chief difficulties encountered in drying forage by this means is due to the fact that when piled up, it becomes almost impermeable, whereas in the case of cereals, on the contrary, the air is diffused regularly through the mass. In some heaps, the parts subjected to the air passing through the pipe were in excellent condition, whereas the opposite portions contained over 14 % of moisture, so that moulds made their appearance, or else the temperature rose and the forage became carbonised.

The shape and size of the frames wooden around which the forage is piled are of the greatest importance. Those used had two disadvantages: 1) the air could not be distributed through the entire heap; 2) the amount of grass was too great, and as its pressure was exerted just above the central chamber, parts of the pile were rendered impermeable.

R. D.

Industrial Crops.

59. Cotton in China.

AUTHORITIES:

I. — *Reply to the Cotton Questionnaire of the International Institute* giving the most recent data available, supplied by the Chief of the Bureau of Agriculture and Forestry. Peking, 1923.

II. — *Bulletins of the Chinese Government Bureau of Economic Information*, April 4 and September 30. Peking, 1922.

III. — *Details of Chinese Cotton Mills*, 1922, compiled by the Chinese Cotton Millowners' Association for the Government Bureau of Economic Information. Shanghai, 1923.

IV. — *Communications to the Bureau of Agricultural Economics*, Washington, by the Special Commissioner of the United States Department of Agriculture, December 18, 1922, and 15 January, 1923.

V. — *The China Yearbook*, 1921-1922 (London).

VI. — *International Cotton Bulletins* (Manchester), No. 2, December, 1922; No. 4, June, 1923; No. 6, December, 1923.

VII. — *Encyclopedia Britannica*, "China", Vol. VI, p. 178. (Eleventh Edition).

VIII. — *The Cotton Growing Countries*. International Institute of Agriculture, Rome, 1922.

According to information contained in the Article on China in the Encyclopedia Britannica, Eleventh Edition, cotton has been grown in that country for more than five thousand years. The compiler of the article on Cotton in the China Yearbook considers that cotton was unknown in China prior to the 13th Century A. D.

In pictures of the Chinaman of several hundred years ago, he is portrayed in clothing closely resembling the cotton garments worn by his descendants to-day, and it is reasonable to conclude that the material was actually the same. We find that cotton is, at the present day, grown in no fewer than fourteen provinces of China, between lat. 23 and lat. 40; extending also for a great distance east and west. This widespread cultivation may be considered as good evidence of its adoption at an early period. Changes of any sort in China have usually been very slow, the population being accustomed to follow traditionary modes of life, to the exclusion of new ideas.

It is, however, in ten provinces out of fourteen, that cotton is produced on a commercial basis, and it is only by forming estimates of area and production in some of these ten provinces that any real idea of Chinese cotton possibilities can be established. Any such estimates must, of necessity, be incomplete, but it may suffice to say that China certainly ranks third among the world's cotton-growing countries in point of quantity, next after the United States and India.

The valley of the Yangtse River takes the lead as the locality for Chinese cotton production; the climate is relatively mild, and there is a wide

extent of fertile soil in portions of the provinces of Kiangsu, Anhui and Hupeh. In Chekiang and Kiangsi, towards the east coast, in Chih-li, Shangtung, Shansi, Shensi, and Honan further northward, the area under cotton is very large. In some districts along the banks of the Yellow River cotton-growing is almost the only profitable agriculture carried on by the peasants, apart from the production of food for their own wants.

On account of the wide range of climate the dates of planting vary considerably, but, this operation usually takes place in the latter half of April. Climate also affects the ripening period, but picking generally begins early in August, and continues until winter sets in.

The work throughout is effected by the peasant cultivators, who are very numerous but seldom deal individually with any but the smallest areas. If left to themselves they give very little attention to method in picking with a view to keeping the cotton clean.

The qualities grown vary considerably ; the cotton produced in the Tungchow and Tsongming districts of Kiangsu Province is considered to be the best in China. The fibre is fine and tenacious, with a bright white colour and staple of $^{7}/_{8}$ inch (22 millimetres).

In the Yuanmoon district of Hupeh Province, fine fibre of a white colour is also produced, with a staple of $^{3}/_{4}$ inch (19 millimetres).

In Chih-li Province (Wuga district) the quality is good with a staple of $^{3}/_{4}$ inch (19 millimetres), as also in Honan Province.

In Shangtung the lint usually measures $^{7}/_{8}$ inch (22 millimetres).

Very little Chinese cotton reaches a length of one inch (25 millimetres) ; if carefully picked, the whiteness is, however, remarkable.

Of cotton plant enemies, the cutworm (*Agrotis ingrata*) is probably one of the most injurious. On progressive farms the ensuing remedial measures are those most commonly adopted. Previous to planting, the seed is mixed with millet already boiled up with kernels of bitter apricot or with arsenic compounds. On the appearance of seedlings a close inspection is made in order to identify any injured stems or leaves. The infected seedlings are dug out by the roots, the seed being again examined for traces of injury.

When the fully developed insect appears, lamps are placed near shallow pans of kerosene in order to attract the pest after nightfall.

The attack by a species of Lepidopteron (*Coleophora* sp.) is usually identified by the presence of small cavities on the surface of the boll, and internal damage is discovered if the boll is opened. Such bolls are immediately burnt. During September and October cocoons of this insect in the chrysalis stage are noticeable on the stems and branches. When picking is completed the stems are uprooted and the infected ground is cleared. Lamps are also useful in eradicating this pest.

Anthracnose (*Glomerella Gossypii*), mosaic and angular leaf spot are the most common of the plant diseases affecting cotton, and the usual remedies are applied.

Very strenuous attempts to improve the type of seed employed are being made by the Chinese Cotton Millowners Association and other bodies interested. The aim is to introduce American Upland seed into all districts

accessible to outside influence, and thus to raise the quality to a level which would improve the position of growers by obtaining a better yield and that of spinners by enabling them to utilize Chinese cotton only, without resort to foreign varieties. It was found possible to organize, under the auspices of the Chinese Cotton Millowners Association, acting through the University of Nanking, an elaborate system of selecting good plants on experimental farms, so that in 1922 there were already large fields of uniform character and quality, both lint and seed being superior to the original standard. Each field contains exclusively descendants from a single superior stock, and thus a uniform new strain is produced possessed of the most stable characteristics obtainable.

Several very superior strains have thus been derived, and the best of them will quickly be utilized. The policy of growing a number of plots of good American cotton by the main roadsides has proved to be of great educational value. Surveys, lectures, exhibits and conferences have been held throughout two of the largest cotton districts in Kiangsu and Anhui, with the result that the interest shown has almost outgrown the capabilities of the University Staff. The training of cotton workers at the University has been carried out systematically with different types of students, amongst whom are selected men brought from a distance to learn methods of cotton farming and ginning. In the summer school, a six weeks' class of thirty students took up eagerly the problems of cotton cultivation. Nevertheless, the obstacles in passing from the experimental to the practical and commercial side are very formidable. The grower, for instance, is unaccustomed to the special methods requisite for making the most of American seed and, unless duly instructed, finds himself unable to get satisfactory results. Thereupon he may become discouraged, and return to his indigenous seed, which is usually a mixture of several varieties, no process of selection being attempted. Even if good quality is produced, the grower often has recourse to traditional practices of adding extraneous matter, or of watering the bales, in order to increase their weight. Colour and cleanliness suffer greatly, while the labour and trouble of expert propaganda are liable to be completely neutralized. Much has been attempted in the way of instruction, and here and there results may be classed as satisfactory.

The process of *ginning* cotton in China is chiefly carried out by machines invented in that country, generally known as " knife gins," and worked by hand. Naturally the time consumed is very long, and various attempts have been made to introduce the American saw-gin. This machine was, however, found to be unsuitable for the very short-stapled and brittle Chinese cotton, as it cuts the lint seriously. The native knife-gin, on the other hand, has a tendency to cut the seed, and thus turns out a lint that is not particularly clean.

The American Special Commissioner regards this state of things as a direct challenge to mechanical inventors in the United States, for the discovery of a system more suitable for ginning the vast crop of native-grown Chinese cotton. There is, of course, no difficulty in employing the American saw-gin for cotton grown from Upland seed and kept separate.

As the population of China is estimated at about 440 millions, the domestic manufacture of cotton is on a vast scale, especially in the more remote provinces, whence very little of the cotton produced finds its way to any spinning mill. In many parts of China there is a loom in most dwellings, so that spinning and weaving on hand looms is almost universal. Besides the material locally manufactured, the whole of the imports of Indian and Japanese yarn is worked up into cloth by the women of the family. Four-fifths of the clothing of the lower classes is said to be supplied by domestic industry. Spinning mills now, however, exist in considerable numbers, being located chiefly in or near Shanghai, which city includes within its limits a large majority of the mills, as it is most conveniently situated for traffic along the Yangtse River, and on other inland navigable waters.

Of the remaining factories included in the Chinese Cotton Millowners Association almost all are in the northern Provinces of Chih-li and Shangtung. The chief dependence of the mills for their raw material is on Chinese-grown cotton, though an admixture of imported American is at present necessary.

The great advance in prices of American cotton, owing to recurrent short crops, makes the Chinese spinners most anxious to improve the quality of the home-grown products. Permission to carry on cotton spinning in China was refused to foreigners until the right to do so was secured by the Japanese Treaty after the War of 1894-95. A large proportion of the spinning mills are now owned by Japanese, who have greatly developed their activities in this direction during recent years. A few British-owned mills are also in operation.

With the exception of import and export figures, which are prepared and published by the Chinese Maritime Customs, there are scarcely any trustworthy data relating to cotton, within China itself. Tabular statements of area and production are in existence, but almost all are drawn up in such a way that comparisons of one season with another are scarcely possible. Generally speaking, the absence of definite system in arriving at results of compilation tends to give an air of unreality to the statements. For this reason, as well as on account of the fragmentary nature of the crop estimates, no attempt is made in this paper to define the quantity of cotton actually grown in China. An article on the subject, published in the International Cotton Bulletin (Manchester), June 1923, mentions estimates of average production ranging from 12 million to 24 million centals of 100 pounds, while in a subsequent number of the same Bulletin, dated December 1923, an estimate of 16 million centals is quoted.

Guerilla warfare and troubles caused by the bandits, so numerous in the interior of China, are responsible for shutting up cotton supplies within the producing districts. The cotton-growers find it difficult and even dangerous to forward cotton to the manufacturing cities, and the return journey with the resulting silver dollars is even more hazardous. When cotton, which has already paid tax on the way to market, comes within the reach of any troops, it is apt to be held for further taxation. This imposition is sometimes regarded as a form of insurance premium, but, even so, it

increases the expenses of transit and renders trading difficult. Amid such conditions the yarn dealers in the interior have not the courage to place any new orders, so that large quantities of yarn accumulate at the ports. The railways have been devoted to the service of troops, and very little merchandise traffic is practicable. For these reasons the price of yarn is depressed, although that of cotton advances.

This short account of one of the very important industries of the world. affecting an immense number of people, may perhaps serve to clear up some points of fact, but in the present condition of China, it is impossible to marshal details of production or of manufacture on a scale sufficiently comprehensive to deal with the vast cotton crop that country.

J. H. H.

60. **Cotton Culture.**

KOCH, PIETER (Manager of Rustenburg Experiment Station). *Journal of Department of Agriculture*, Union of South Africa, Vol. VIII, No. 1, pp. 39-50. Pretoria, 1924.

In this article the author gives a detailed account of the botanical features of the cotton plant, the chief varieties, climatic and soil requirements, rotations, soil preparation, cultivations, harvesting, ginning and preparation for market of the cotton lint. W. S. G.

61. **Growing the Pima Variety of Cotton under Irrigation in South Africa.**

OOSTHUIZEN, J. DU P. (Manager, Experiment Station, Rustenburg). *Journal of the Department of Agriculture, South Africa*, Vol. VII, No. 3, pp. 250-254. Pretoria, 1923.

The present year's (1923) output for South Africa of the Upland types of cotton is estimated at about 1 500 000 lb. of lint, practically all of which was grown without irrigation.

Under various schemes of irrigation thousands of acres of land suitable for cotton are available, but such land is somewhat expensive, hence, can be used only for the highest priced cotton. For this reason one of the long-stapled varieties is recommended, such as Sakellarides, the Egyptian variety, and Pima, an American-Egyptian type propagated in Arizona, both of which were tested at Rustenburg, and as a result of these trials it was decided to continue with Pima, and seed was distributed to a number of farmers.

In 1922 at the Rustenburg Station a yield of 1386 lb. of seed-cotton per acre was obtained, and as the seed is now acclimatised even better yields might be expected. Both colour and strength were good and the staple was 1 ½ inches. This particular crop was planted rather late and followed a winter crop of barley and in consequence the land was not in the best condition.

As regards irrigation, this will depend on the rainfall ; the first irrigation will take place six weeks after planting, the next, two or three weeks

later, after which it may be necessary to irrigate every fourteen, or even ten days during dry spells.

The saw gin is used for Upland type cotton, but a roller gin was installed to meet the requirements of the long-stapled Pima variety.

As this cotton is altogether different from Upland, it will not be possible to market it through the same channels, and standards and grades will have to be established on the lines adopted by the United States in 1917 for Pima cotton, or similar to those of the Egyptian types and grades.

W. S. G.

62. **Cotton Variety Tests.**

BRIGGS, C. *Experiment Station Record*, Vol. 49, No. 5, p. 432. Washington, 1923.

The *Oklahoma Experiment Station Bulletin*, No. 141, 1923, gives details of yield with estimated money values for about 40 varieties and selections of cotton which have been compared at the Station from 1916 to 1921 inclusive. Results for 1922 are included, with directions for growing cotton under boll-weevil conditions. Oklahoma Triumph 44 and Harbville No. 12 averaged highest in yield and value of seed and lint.

W. S. G.

63. **Flax Growing in East Africa.**

GRAY, W. S. (Technical Adviser, International Institute of Agriculture, Rome).

In East Africa as in other countries, flax has suffered severely from the depressed state of the markets, but there is no doubt that it will in the near future regain its former position as one of the most profitable of fibre crops.

In 1913 Great Britain and Ireland imported over 80 000 tons of flax and tow from Russia, but a long time will probably elapse before these figures are again reached and countries that are able to supply the deficiency of raw material for the linen industry are worthy of consideration.

In Kenya in 1920 flax occupied 24 174 acres (11) and subsequently extended this acreage, after which there has been a falling off owing to low prices. The Colony is well suited to flax owing to the soil and temperature of the highlands and the two rainy seasons which enable two crops to be grown in one year. The most suitable districts are probably, Nakuru, Wasin Gishu, Lumbwa, Kericho and Kyambu, but others are being developed rapidly. These are all situated in the highlands and lie mostly at altitudes of 6000 to 8000 ft. and have rainfalls varying from 50 to 75 inches.

Flax will thrive on almost any well-drained soil, but murrum land should be avoided.

Native labour can be trained, under supervision, to carry out the necessary cultivations, also to harvest the straw and scutch the fibre.

The time required for the crop to mature varies according to climatic conditions, but from 3 to 4 $\frac{1}{2}$ months is usual, and this period may be di-

vided into four stages, as follows 1) the time from germination of the seed to that preceding the formation of regular foliage leaves ; 2) from the first stage to the time of blossoming ; 3) the period of flowering and boll formation ; 4) maturation (2).

Only the finest quality seed should be used, and as it is costly to import, time is well spent in the selection of plants that grow best and ripen first

Variety	Weight per acre of dried deseeded straw		Yield per acre of scutched flax and rescutched tow		Yield per acre of scutched flax and rescutched tow		Percentage of scutched flax and rescutched tow from retted straw		Percentage of scutched flax and rescutched tow from retted straw	
	Before retting	After retting	Water retted		Dew retted		Water retted		Dew retted	
			Flax	Tow	Flax	Tow				
	Cwts	Cwts	Stones (a)	Stones	Stones	Stones	Flax %	Tow %	Flax %	Tow %
English Dutch Child	24	18	23 1	5 10	24 0	5 10	16	4	16 1/2	4
Japanese	14	10 1/2	11 7	4 3	13 6	3 11	14	5	15	4 1/2
Canadian Ontario	20	15	15 8	6 0	16 11	4 11	13	5	14	4
Canadian Western	29	14 1/2	16 0	4 7	17 1	4 7	14	4	15	4

(a) 1 stone = 14 lb.

and these should be allowed to mature fully ; the seed should be carefully cleaned and stored and sown next season, as by so doing for several seasons, the yield and quality of fibre will steadily improve. No seed should be purchased without a guarantee of freedom from wilt or other disease.

In 1920 several varieties of seed were experimented with at the Government Farm, Kabete, near Nairobi, data of which are given above (3).

Dutch and Russian varieties are generally recommended, but there is a species of white flowering flax in the country which is later in maturing and longer and coarser than the Dutch Blue ; the latter is to be prefered.

There is a difference of opinion as to whether seed deteriorates in weight in Kenya by being grown successively on the same land, but the author's experiments carried out for three seasons only, showed a decided decrease in weight per 1000 seeds.

It has generally been found that imported seed is reduced in germinating power. The author found that seed which in England was guaranteed as 96 % germinating capacity was found on arrival to average 55 % only (4). The loss in this case, on 600 bags was considerable, and every encouragement should be given to the Kabete Station, so that suitable strains may be produced in the country and such losses avoided. Very important work has been done on the isolation of improved strains of flax at the Flax Research Institute, Lambeg, Belfast.

An examination of a cross-section of a flax stem under the microscope shows the fibres arranged in irregular bundles, near the outside of the stem.

In some cases they form almost a continuous ring of fibre; in other cases the bundles are in isolated groups, hence, flax stems of equal breadth may not carry the same amount of fibre. Whether this variation in fibre distribution lends itself to plant selection has not yet been ascertained (5).

Too much stress cannot be laid on the necessity of having the land in good condition. Flax is not a suitable crop to sow on newly broken ground, which as a rule is extremely difficult to get into fine tilth; a clean, compact seed bed is required which will allow of the seed being covered to a uniform depth; if this is not done it is impossible to obtain an even crop; the soil should be rolled both before and after sowing.

The quantity of seed to be sown varies with climatic and soil conditions; in England it is usual to sow from 112-140 lb. per acre, or even as much as 180 lb. when it is desired to obtain very fine fibre, but in Africa from 70 to 90 lb. will be found sufficient, more seed being required as the altitude increases.

Sowing may be done by broadcasting by hand, or by the "fiddle", which is generally employed, or by means of a seed-borrow, but the latter needs constant inspection of the brushes. The seed should not be allowed to lie long on the ground exposed to the tropical sun, but should be quickly harrowed under.

There is no doubt that several crops may be successively grown on virgin soil, especially on land that has formerly carried forest, but to safeguard against disease it is better to rotate with other crops such as maize, wheat or beans.

Weeding can be continued until the plants are about six inches high, but on some soils nothing seems to eradicate bracken, which by harvest often seems to form fifty per cent. of the crop, and adds greatly to the labour and cost.

The usual advice in Ireland is to pull the flax while the stems are still green, but in Africa the straw must be more mature or the quality of fibre will suffer.

Several machines for pulling flax have been devised, but with a supply of cheap labour at hand, manual pulling is best. Ten boys will pull about an acre per day, but supervision is necessary, otherwise they will bend and break the straw, causing loss of both time and money at later stages.

In many parts of the East African highlands, for several months in the year the mornings are brilliantly fine, but rain falls heavily almost every afternoon, and some method such as the following must be adopted to dry the straw as rapidly as possible when pulled. The straw is placed by the puller in even windrows on the ground and left for one or two days, after which it is tied into small beets, and stood up in shocks for two days, when the beets are built into small stacks termed 'barts'; these are left for a week or ten days and then the straw is placed in barns, where it should remain for several weeks before deseeding.

Where timber and thatching grass are available, good barns can be built with native labour at little expense; a suitable size is 50 × 20 ft. and 18 ft. to the ridge pole; such a barn will hold about 50 tons of straw, the product of 20 acres.

The straw may be deseeded by passing between power driven rollers, but with a good supply of native labour " rippling " has many advantages. Rippling combs can be made on the shamba (farm) by driving a row of 6 or 8 inch iron pins through a tough plank, points upwards, the distance between being from $^{3}/_{16}$ to $^{4}/_{16}$ of an inch. The seed bolls are removed by drawing the straw through the pins. The seed must then be cleaned by passing though a winnowing machine.

The next process is that of retting the straw, in order to separate the fibre from the woody part of the stem, these two parts being held together by a pectic substance which can be destroyed by bacterial action. There are two regular methods of effecting this, water retting, and dew retting. In Britain and Ireland the former is generally employed, but in East Africa dew retting gives the best results ; many flax growers have tried water retting and experiments have been made at Kabete, the conclusions arrived at after these experiments being that " water retting is a failure under all methods tried as yet " (3).

In dew retting slightly less than one ton of straw is spread in rows on an acre of land, and exposed to rain and dew, the process occupying about 20 days as a rule, during which time the straw should be turned three or four times. In Ireland, from 6 to 8 weeks are necessary. Retting should only be carried out during the rainy seasons as excessive exposure to the tropical sun give the fibre a yellow-red tint and lowers the quality. Experience is necessary to judge when the process is complete ; the straw should be uniformly dark and easily broken, and the wood should separate from the fibre when the straw is rubbed between the fingers. The retted straw should always be stored for several weeks before being taken to the scutching mill.

A convenient size mill is one containing 30 stocks, arranged in two sets of 15 ; in addition, the following would be required : 1 de-seeding roller, two 6 or 8 pair breaking-rollers, and a 42 H. P. engine and boiler with special fire-box for burning flax shive. A baling-press is also necessary.

The above plant should be sufficient to deal with the product of 400 to 500 acres of flax land.

Cleaning the straw from the fibre is done by the aid of power-driven scutching-wheels, which may be of the Irish, or heavy, six-bladed type, or the Belgian, with twelve light blades. It is probable, however, that a type with ten medium blades would suit the fibre of the country better than either. Musharagi is a good, hard, local wood for making the blades. Scutching-wheels are frequently driven too fast, and so damage the fibre.

Before scutching, the straw is passed through the breaker, to break up the woody part of the stems, which are usually dry and brittle, and require less breaking than in Europe. In East Africa, with native labour, the output per man per day of scutched fibre is from 25 to 30 lb. ; in Ireland the average is about 56 lb. and a very good scutcher will turn out 70 lb.

To obtain the best prices on the market it is essential that the fibre be well graded ; this should be roughly done immediately after scutching,

but the final grading should always be done by a professional grader in order to obtain uniformity.

Flax fibre should be carefully stored in well-thatched sheds, preferably sunk half underground, as the aim is to keep the store cool and humid as by so doing the fibre will improve in quality.

The fibre is often lowered in quality by excessive pressure in the baling press; 90 to 100 cubic feet to the ton is sufficient.

The yield per acre is about 38 to 40 cwt. of dried straw, from which is obtained approximately fibre 1.70 cwt., tow 2.35 cwt. and linseed about 2 1/4 cwt. These are the official figures for 1920 (1), but higher total yields and a much higher percentage of fibre to tow may be obtained by good cultivation and more skilled scutching. In Ireland the yield of fibre for the ten years, 1904-1913 averaged 4.12 cwt. per acre, not including tow, which would be about 1 cwt. in addition.

At the Nakuru Agricultural Show in 1920 the flax exhibits were of high grade and compared favourably with European flaxes, and there is every reason to suppose that when the market conditions are again favourable, flax growing will become one of the standard industries of East Africa.

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64. Observations on the Cultivation and Value of Abaca (*Musa textilis*), as a Fibre Plant.

I. — FERRER, L. G. and ESPINO, R. B. A Study on the Germination of Abaca Seeds. *The Philippine Agriculturist*, Vol. XII, Nos. 3 and 4, pp. 101-104, tables 7, bibliography. Los Baños, Laguna, 1923.

II. — ESPINO, R. B. and CRUZ, S. M. Absorption of Complete Culture Solutions by Abaca Roots with reference to Growth of Branch Roots. *Ibidem*, pp. 111-119, tables 5, plates, 1.

III. — HERNAIS, P. and ESPINO, R. B. Soil Moisture Requirements of Young Abaca Plants. *Ibidem*, pp. 121-126, tables 2.

IV. — ESPINO, R. B. and VIADO, B. O. Preliminary Study of the Salt and Fertilizer Needs of the Young Abaca Plant. *Ibidem*, pp. 127-132, tables 3.

V. — Gavarro, P., and Espino, R. B. Foliar Transpiring Power of different Varieties of Abaca grown at the College of Agriculture, Los Baños. *Ibidem*, pp. 135-140, figs. 2.

VI. — Mendiola, N. B., On the Improvement of Abaca (*Musa textilis* Née.) *The Philippine Agricultural Review*, Vol. XVI, No. 2, pp. 85-99, bibliography, Manila, 1923.

I. — *Germination.* — A series of experiments was made at the College of Agriculture, Los Baños 1922-23 to ascertain the conditions influencing the germination of abaca seeds (*Musa textilis*). Results indicated : 1) that the plant is cross-pollinated ; 2) seeds obtained from different bunches of fruit of one variety show a variation in germinating power, but the seeds of different varieties have about the same degree of viability ; 3) the degree of viability does not depend upon position ; 4) drying seeds in the sun causes a loss of vitality. A higher percentage of germination is obtained from seeds planted directly after removal from the fruit pulp ; 5) variations in viability when soaked in water at different temperatures, and the deleterious effect of high temperatures ; 6) no advantage obtained by pre-soaking in inorganic acids ; 7) all seeds fed to chickens are digested ; those fed to man have the highest percentage of germination and in the shortest time ; 8) loss of vitality may occur about three months after collecting the seeds. However, seeds buried in the ground may remain alive for 155 days.

II. — *Absorption of nutrient solutions.* — In the abaca nursery at Los Baños, eight different sets of molecular salt solutions were employed and a selection of roots tested. The authors state that according to the somewhat limited amount of data evolved, the following generalisations may be made (making allowances for the modifying factor of the branch roots) : 1) the culture solution most readily absorbed was characterised by the relatively medium amounts of mono-potassium phosphate or calcium nitrate, and relatively high magnesium sulphate content ; 2) ammonium sulphate is apparently not a vital necessity to the plant ; 3) a root clump should absorb about 2.4 kg. of solution in a day.

III. — *Soil moisture requirements.* — A preliminary study made with seedlings tested on a rich loam from an alluvial deposit and weekly measurements were taken. It appears : 1) that seedlings should not be grown even in a fertile soil if the degree of saturation is less than 50 % ; 2) alluvial soil saturated with water is unsuitable ; 3) optimum moisture requirements 60-80 %, 70 % produced the best vegetative development.

IV. — *Salt and fertiliser requirements.* — A study of the effect on fibre yield and the quality. Although applicable only to soil and climatic conditions in Los Baños, the following generalisations may be drawn : — abaca fibre may improve in quality and quantity with the [illegible]ation of either calcium nitrate or ammonium sulphate, and as regards, nitrogen requirements the plant may be classified with rice and tobacco. Sodium nitrate gave unsatisfactory results. Successful results have been obtained when potassium sulphate and double superphosphate are applied in conjunction with ammonium sulphate.

V. — *Transpiration capacity.* — Twelve varieties adapted to regions having prolonged drought were investigated and the cobalt-chloride test employed. The figures indicated the comparative transpiration capacity of the different varieties and the rate of transpiration and evaporation every half-hour. Observations show that the index of transpiration was from 2-5 times greater for the lower than for the upper surface.

VI. — *Cultivation and improvement.* — Abaca or Manila hemp is essentially a Philippine monopoly and the author after reviewing the developments in Java and elsewhere, draws attention to the factors important in maintaining a profitable yield of fibre in the Philippines and the need of better varieties: *a*) resistant to drought; *b*) adapted to different types of soil; *c*) high yielders of easily stripped fibre of good quality; *d*) early bearers and *e*) comparatively long-lived. Of the varieties at present recognised by planters, the "Tangongon" possesses qualities (*a*) and (*b*), the "Maguindano" (*c*) and (*e*) and "Bongolanon" (*c*) and (*d*). A combination of all five qualities has, however, yet to be effected.

The methods recommended for propagation are discussed and it is considered inadvisable to use abaca seeds for commercial propagation due to the heterogeneity of the forthcoming crop. For obtaining new desirable varieties, however, this factor is an important consideration. Under ordinary conditions the seeds does not germinate very readily, 5-30 days according to temperature. Cross-pollination is advocated for commercial production.

M. L. Y.

65. Mauritius Hemp *(Furcroea gigantea)* with reference to its Inferiority to Abaca, Maguey and Sisal.

Espino R. B. and Novero T. *Philippine Agricultural Review*, Vol. XVI, No. 2. pp. 108-119. tables 5, figs. 3. Manila, 1923.

Notes on nomenclature and distribution of Mauritius hemp (*Furcroea gigantea*) followed by a description of the plant, yield of fibre, reactions of chemical solutions, ash content and tensile strength compared with maguey and sisal, and general economic importance.

M. L. Y.

66. Pita and Silk Grass.

Wright, C. H. *Bulletin of Miscellaneous Information, Royal Botanic Gardens, Kew*, No. 7, pp. 266-267. London, 1923.

The names "pita" (Central and South America) and silk grass (British Honduras) have been given to several fibre plants, including agaves and *Bromelia* spp. A species sent from Colombia to the Royal Botanic Gardens, Kew, was identified as *Bromelia Magdalenae*, of which a full description is given.

M. L. Y.

67. **Utilisation of *Dendrocalamus Brandisii* Kurz.**

CAMUS, A. Utilisation du *Dendrocalamus Brandisii* et de quelques especes voisines. *Revue de Botanique appliquée et d'Agriculture coloniale*, Year 3, No. 27, pp. 777-778. Paris, 1923.

Dendrocalamus Brandisii Kurz is a tall bamboo growing in East Asia at an altitude of between 1000 and 1300 m. It is used in basket-making and the manufacture of pulp for paper ; a fine flour is prepared from its seeds, while the young shoots, which lose their bitter taste when boiled in water, are much eaten (being more tender than asparagus) and if they were tinned, would find a ready market and become the basis of a profitable industry. R. D.

Oil crops.

68. **Composition of two Useful Philippine Oil Seeds.**

I. — WEST, A. P. and BALCE, S. (University of the Philippines). Composition of Pili-Nut Oil (*Canardium ovatum*), *The Philippine Journal of Science*, Vol 23, No. 3, pp. 269-276, tables 6, bibliography . Manila, 1923.

II. — WEST, A. P. The Composition of Cashew Nut Oil *Ibidem*, Vol. 23 No. 4, pp. 337-344. tables 5, bibliography. Manila, 1923.

A preliminary survey is given concerning the habits and distribution of two trees producing oil seeds of economic value, viz. " pili-nut " (*Canarium ovatum*) and " cashew nut " (*Anacardium occidentale*). Reference is made to foregoing observations on the oil content of other *Canarium* spp. and to favourable reports in India and elsewhere as to the value of *Anacardium* spp.

A detailed analysis has been made at Manila and the author gives a full description of the results obtained : It appears that both the oils are edible and possess good keeping qualities and have the following composition.

	Oleic glyceride	Palmitic glyceride	Stearic glyceride	unsaponifiable matter	saponification value	acid value	iodine value	specific gravity
	%	%	%	%				
Canarium ovatum	59.6	38.2	1.8	0.2	197.4	1.42	55.9	0.9
Anacardium occidentale . .	80.4	—	17.3	1.5	187.0	1.45	85.20	0.9

Details concerning the separation of the saturated and unsaturated acids are included. The value of the cashew oil cake is evident from the following data : — oil 16.12 % ; protein 31-76 % ; carbohydrates 45.46 %. M. L. Y.

[67-68]

69. **Chemical Analyes of *Jatropha stimulosa*.**

MENAUL, P. *Journal of Agricultural Research*, Vol. XXVI. No. 6. pp. 259-260. Washington, D. C., 1923.

An analysis of the spurge nettle seed (*Jatropha stimulosa*) was made by the author at the Oklahoma Agricultural Experiment Station, and results indicate a high percentage of fat (50.91 %), and protein (33.3 %). The oil was extracted by pressure and gave a clear yellowish semi-drying fluid of somewhat less viscosity than castor oil, and with a pleasant taste. Results show specific gravity 0.9257 at 15.6° C. ; refractive index 1.47 at 15.6°C.; solidification below —15°C.; iodine value 124.6 to 129.4 ; saponification 186.4 ; volatile fatty acids, none ; free fatty acids, trace ; fatty acids 95.6 % ; glycerin about 4.2 %.

The solubility of the protein in various solvents was examined and also nitrogen determinations. It is evident that the protein contains a high percentage of histidin. The analysis shows clearly the nutritive value of the seeds. M. L. Y.

70. ***Pachystroma acanthophylla*, a Brazilian Oleiferous and Forage Plant.**

BOMFIN, U. (Inspectoria agricola federal do Estado de Bahia). A favelleira como productora de oleo e de forragem. *Chacaras e Quintaes*, Vol. XXVIII, No. 2, pp. 103-104, fig. 1. São Paulo, 1923.

In the forests of North Bahia, and of the bordering States, there are large numbers of the Euphorbiacea, *Pachystroma acanthophylla*, a tree which grows to the height of 3-6 metres.

The leaves form an excellent forage, but only when dry, for they are covered with stinging hairs. An edible oil resembling that of the earth-nut, is made from the seeds. The author advises that this tree should be utilised, for so far, even the wild individuals have not been exploited in any way. Since the name of *Pachystroma acanthophylla* does not appear in any of the works on the useful plants of Brazil, consulted by the author, it would seem that this is one of the many valuable trees of the Brazilian forests which is still generally unknown. R. D.

71. **The Cultivation of the Coco-Palm in Yucatan, Mexico.**

RUL, G. G. El cultivo del cocotero en Yucatán. *El Agricultor*, Year X, No. 9, pp. 19-22, No. 12, pp. 10-12 ; No. 15, pp. 8-10. Yucatán, 1923.

The author states that the coco-palm is very well suited to the conditions found in Yucatan, and is of opinion as a result of his numerous observations, that this valuable tree is one of the most profitable plants that can be introduced into that country. The zone best suited to the coco-palm is a belt in the coast some 3-4 km. in width, which catches the sea-breezes laden with salt that are essential to the well-being of this tree. *Cocos nucifera* will also grow in the hinterland, but produces a smaller crop than in the vicinity of the sea. Irrigation is not

indispensable to its welfare, indeed, this tree grows luxuriantly along the shore on soil which is never irrigated.

The seeds are sown in the nursery, the seedlings being transplanted later and placed in holes 1 m. or more in width and depth, according to the nature of the soil, in which they remain a year. Nuts with brown, yellowish, or green integuments are kept for seed ; the latter, which are the smallest, are to be preferred. The best position for the nut is with the crown (the point of insertion of the peduncle) turned upwards. The practice of planting the nut in the reverse position, with the object of obliging the plumule to turn round the nut and thus reduce the height of the trunk to such an extent that the fruit is within easy reach, has now been discarded for it rendered the young seedlings more liable to the attack of a beetle known as " lucano ", or " cucarachón ", (probably *Oryctes rhinoceros*). The seed-plot must be shady and the air and soil very damp. The best spacing is 6-7 m., the seeds being planted in squares. In order to replace any seedlings that may die, it is well to plant twice as many nuts as the adult trees required. Until the palms begin bearing, maize, beans, pumpkins, melons, cucumbers, onions, potatoes, etc., can be grown between the rows.

The author gives the cultivation cost up to the first year of bearing (which is the 6th year). The first crop brings in a large profit. J. P. C.

72. **The Treatment of Young Coconut Plantations.**

STOCKDALE, F. A. (Director of Agriculture, Ceylon). *The Tropical Agriculturist*, Vol. LXI, No. 5, p. 305, Peradenya, Ceylon, 1923.

The author draws attention to the usual methods of bringing young coconut plantations into bearing in Ceylon, which are the same as those adopted generations ago. Allusion is made to experiments carried out by L. M. W. WILKINS on an estate in the North-Western Province.

On this plantation holes were dug 3 × 3 feet and when filled in, ashes and fertilisers being mixed with the soil. The root areas of the young palms were kept free from weeds and the soil tilled occasionally.

Planting took place in December 1920 and 1 ½ lb. of fertiliser was given in July 1922, and 3 lb. in July 1923. Vegetable catch crops were allowed to grow over ⅓ of the root area.

The effects of intensive cultivation on the growth of these palms is clearly shown by photographs ; one palm at the age of 32 months had produced 23 fronds.

The cost of fertiliser averages, so far, 53 ½ rupee cents per palm. The author strongly advises all growers to pay attention to their young palms, and mentions that if this were done, plantations in Ceylon would not take an average of 10 years or more to come into full bearing. W. S. G.

73. **" May-Lan " *(Aesculus indica)*, an Oleaginous Seed From Tonkin.**

C. C. Une graine oléagineuse peu connue du Tonkin. Le " May-Lan " (*Aesculus indica*). *L'Agronomie Coloniale*, Year, 9, No. 70, 1923.

The " Institut National d'Agronomie Coloniale (France) has received from Tonkin an oil-bearing seed produced by the plant known as

the " May-Lan " (*Aesculus indica*). This seed resembles a small horse-chestnut, but the cupule appears softer than that of the fruit of *Aesculus Hippocastanum*.

Length, width	21 mm
Average thickness	16.8 mm
Cupules	32.58 %
Kernels	67.42 %

The yield of the shelled seeds varies between 40 and 50 %.

The oil is easily filtered, after which it becomes very clear. It is of a yellow colour, solidifies at 10°-9° C, liquidifying at between 10° and 11°.

Chemical Composition of Kernels.

Moisture	4.32 %
Fats	65.28 »
Nitrogenous substances	12.31 »
Ash	2.54 »
Saccharifiable substances	10.11 »

The tree grows on rocks; its girth never exceeds 20 cm.; the wood is very hard.

The seed contains much more oil than the seed of May-Chan (*Carya Tonkinensis* H. Lec.) but the product is greatly inferior in quality to the oil obtained from the latter.

Swine and wild boar are reported to eat with avidity the fruits of *Aesculus indica*.

Physical Properties of the Oil.

Density	0.916 at 15° C
Acidity	0.955 (oleic acid)
Saponification number	223.6
Iodine number	56.90 %

R. D.

74. Mangrove-Swamps in Sumatra (Dutch East-Indies).

LUYTJES, S. A., De Vloedbosschen in Atjeh. *Tectona, boschbouwkundig tydschrift*, Vol. XVI, No. 7, pp. 575-601, 1 pl. Buitenzorg, 1923.

The most important mangrove swamps are situated on the east coast of Atjeh (Sumatra). On the west and north coast the swamps are of small extent. On the east coast of Atjeh there are three large mangrove swamp areas. The rights of exploitation of 70 % of these (about 40 000 ha.) are ceded to private concerns. There are three kinds of mangrove swamps: those on grounds *a*) wholly flooded at high tide, *b*) partially flooded at the high tide, *c*) only flooded at the highest tides. The mangrove swamps under *a*) are the best and the easiest to manage and to regenerate. These under *b*) yield woods of inferior quality and their regeneration offers more difficulties. Those under *c*) should in the authors opinion, not be considered as real mangrove swamps.

The timber yield of the individual trees seems to be far less than in the mangrove swamps of Java (Kinderzee). Probably this is due largely to a different way of calculating the yield in that country. The economic significance of the mangrove swamps depends on their situation On the west coast they are very small, but on the north coast they are of more importance. The swamps should be protected and cultivated. On the east coast they are of great importance : 1) to the natives for domestic use, 2) for the charcoal burners, 3) for the railways as fuel, 4) for the tobacco-plantations as timber, and 5) for the tanneries (barks).

Preservation of the existing mangrove swamps and regulation of their exploitation is urgent. The government is powerless against the present most wasteful exploitation by private owners. The Government tried to buy back the concessions but failed.

The exploitation by the natives is now each year confined to some distinct swamps. In 1922 small areas were given for exploitation to the natives on a rotation of seven years. D. v. S.

75. Mangrove Bark as a Tanning Material, a possible Substitute for Oak Root Bark.

Commercial Bulletin, Government of Palestine, Vol. IV, No. 45, pp. 294-298. Jerusalem, 1923.

General survey of the sources of mangrove supply, manufacturing extract in the producing countries, export trade of the Dutch East Indies and Straits Settlements and the industry in Africa and other countries. Reference is also made to the tannin content of the extract and the methods of blending with myrobolans, sumac, etc., employed in certain countries. M. L. Y.

76. Effect of Manuring on Formation of Latex Vessels.

YATES, Dr. H. S. *Communications of the General Experimental Station of the A. V. R. O. S.* Rubber Series No. 39, pp. 10-12, Tables 2. Buitenzorg (Java), 1923.

The author's experiments showed that the rate of formation of latex vessels is influenced by differences in the soil and that the rate of formation of latex vessel rings may be accelerated by manures.

The effect of soil differences and manurial applications on the rate of formation of latex vessel rings, and on the yield, appear to be approximately equal.

The selection of trees by latex vessel examination seems to offer no advantage over selection by yield measurements, if properly applied over a reasonable period. W. S. G.

77. The Alternate Tapping of *Hevea*.

La Saignée alternative de l'*Hevea*. *Revue de Botanique appliquée et d'Agriculture Coloniale*, Year 3, No. 27, pp. 778-780. Paris, 1923.

The alternate tapping of Hevea has been strongly advocated by M. E. GIRARD, Manager of the plantations of Suzannah and Anloc (Cochin-

China). A Commission has found at Suzannah that the largest amount of latex per surface area obtainable by any method is procured by tapping the trees once every four days. It is hoped to extend the time to once every 8 days ; this plantation has one coolie tapper per 9 hectares. Alternate tapping is now being practised more generally in Cochin-China, Malaysia, and the Middle Eats. M. MARTINI, in his report drawn up for the Saigon Chamber of Commerce, gives the following information respecting the Dutch Indies. The " Société Indo-Belge " has practised tapping once every two days since the beginning of 1921, in which year, each tapper obtained latex in the proportion of 2.765 gm. of the dry product, or on an average, 9.4 gm. per tapping. These returns, in 1920 had been respectively 1.708 gm. and 6.5 gm. Under the same conditions, similar figures (2.266 gm. and 11.2 gm. in 1921, as against 1.762 gm. and 9 gm. in 1920), were recorded at the Kiara Pojoeng plantations.

On the Pasir, Pogor, Boumi, Ayon and Sindgajaja plantations, the trees were tapped every alternate two months. Previously, the trees used to be tapped daily in two places two notches being cut on one-fourth of the circumference, one beginning at 1.50 m. above the ground, and the other at 0.75 m. The yield per tree and per day was 7 gm., or 460 kg., per hectare and per year. Now, only one notch is made on a third of the circumference the incision beginning at 0.85 m. from the ground, and 2 months of tapping alternate with 2 months rest. By this means are obtained 12 gm. per tree and per day, or 422 kg., per hectare annually. In the old method, the round of the trunk was made in 6 years which did not allow sufficient time for the bark to grow again ; the alternate system extends this interval to at least 9 years which exerts a considerable effect upon the duration of the plantation ; further the amount of dry rubber collected every day by one coolie is raised from 2.878 gm. to 4.301 gm.

The " Société Franco-Néerlandaise de Culture et de Commerce " has adopted a method based on the age of the tree ; the length of the incision remains nearly invariable, but the proportion between the cut and the girth of the tree decreases with the increase of sparing the trees which live to grow old and thus prolongs the period of normal yield.

R. D.

78. Cost of Rubber Planting in Sumatra.

The India-Rubber Journal, Vol. LXVI, No. 21, pp. 11-12. London, 1923.

The following figures are taken from a carefully prepared estimate of the cost of planting and bringing into bearing of a rubber estate in Sumatra, but the estimate represents also, with fair accuracy, the expenditure necessary on a similar proposition in Malaya.

The minimum area taken for economical working is 2000 acres. Company formation expenses are not included, but 5 % interest on capital is allowed, up to and including the fifth year.

The cost includes the wages of 500 coolies, and the salaries and bungalows of the European Staff.

The total cost per acre to the end of the fifth year works out at £53 16.8, but as the cost of production is high of young rubber just coming into

bearing, it is suggested that a further allowance should be made for interest on capital until the seventh year, and £100 per acre is a fairly accurate estimate for planting and bringing into bearing of a rubber estate in Sumatra at the present day. W. S. G

79. **Essential Oil from the Gum-oleo-resin of *Boswellia serrata*.**

SIMONSEN, J. L. The Constituents of Some Indian Essential, Oils: The Essential Oil from the Gum-oleo-resin of *Boswellia serrata* (Roxb). — *Indian Forest Records*, Vol. IX, Pt. VI, pp. 1-18, tables, 4. Calcutta, 1923.

Discussion and experimental records concerning the Gum-oleo-resin of *Boswellia serrata* Roxb. M. L. Y.

Sugar Crops.

80. **Soil Sterile as regards the Sugar-Cane in Cuba.**

MUÑOZ, B. Tierras estériles para el cultivo de la caña de azúcar en Cuba. *Agricultura y Zootecnia*, Vol. II, No. 11, pp. 371-372. Havannah, 1923.

The author mentions the fact that there are certain soils in Cuba upon which the sugar-cane will not grow, although in physical structure, origin and environment they appear no different from other soils upon which this plant has been cultivated with great success.

It seems, as a result of numerous enquiries, that this sterility is due to an almost absolute lack of lime in the soil, the lime originally present having been converted into the carbonate, or bicarbonate, and then removed by water. These soils therefore not only suffer fom want of lime which is an important constituent, but also from absence of proper nitrification and from the accumulation of phosphoric anhydride, a substance present in great excess.

Liming has been found to remedy these defects and to render such soils productive for sugar-cane crops. J. P. C.

81. **The Value of Molasses as a Fertiliser to Cane Soils in Mauritius.**

TEMPANY, H. A. (Director of Agriculture, Mauritius) and GIRARD, F. (Assistant Chemist.) Bulletin No. 28 from *Louisiana Planter and Sugar Manufacturer*, Vol. LXXI, No. 25, p. 487. New Orleans, 1923.

The planters of Mauritius are practically unanimous as to the beneficial results of the application of molasses to cane fields. In plant canes it is applied in the holes some weeks before planting or between the young growing cane; to ratoon crops it is applied either around the stools or between the rows. The usual amount is about 4 tons per acre, although as much as 15 tons are sometimes applied.

The general practice in Mauritius is a cycle of one crop of plant cane and five crops of ratoon, and the gain in yield attributed to the application of molasses is estimated to amount to a total increase of 20 tons of cane per acre. Experiments indicate that the increase in yield from virgin or plant cane amounts to 9 or 10 tons per acre. This increase can hardly be attributed to the added plant food material conveyed by the

molasses to the soil, and it is suggested that the cause of increase is probably biological in nature. W. S. G.

82. Testing the Ripening of Sugar-Cane.

The International Sugar Journal, Vol. XXV, No. 300, p. 641. London, December, 1923.

In a series of experiments at the Central Farm at Coimbatore, India, the refractive index of the juice has been used as a means to test the ripening of sugarcane, small quantities being drawn from the joints by a modified hypodermic needle. The results indicate that the cane ripens joint by joint and if samples when taken from the top and bottom joints show refractive indices the ratio of which is close to unity, the cane is at the most suitable state for cutting ; if below this the cane has not matured, and if much above, the cane is over ripe. This should form a useful method in experimental work on cane. The results further indicate that the coefficient of purity is not a reliable criterion upon which to judge the ripeness of cane, as has been generally supposed. W. S. G.

83. The Utilisation of Bagasse in Sugar Cane Cultivation.

Scientific American, Year 79, p. 241. New York, October, 1923.

The use of paper as a surface "mulch" has been suggested in connection with various crops (1).

The Hawaiian sugar planters are utilising their waste bagasse for the manufacture of paper, which is used in the fields, being laid in strips over the rows of young cane. As the cane grows it penetrates the paper, the growth of the plant not being hindered in any way. On the other hand, weeds have not sufficient sharpness or stiffness to penetrate the paper and are, in consequence completely eliminated. W. S. G.

84. Production of Sugar per Hectare of Sugar Beet.

SAILLARD, E. Combien la betterave peut-elle produire de sucre par hectare ? *Journal d'Agriculture Pratique*, Vol II, No. 43, pp. 331-333 and Vol. II. No. 44, pp. 352-354. Paris 1923.

The author refers to the inevitable losses of sugar incurred during storage of sugar beet in the silo, and in the sugar factory during the filtration and evaporation processes. The molasses absorbs a certain quantity and allowance should also be made for polarisation. It is estimated that from 100 kg. of sugar in freshly pulled beets, 77-78 kg. of white sugar is obtainable, 12 kg. is transmitted to the molasses, used for alcohol, fuel, etc. and 10 % remains in the residue. Attention is drawn to the fact that with sugar statistics, it should be recognised that 100 kg. crude sugar corresponds to 90 kg. refined sugar. Figures are quoted from SACHS *Sucrerie belge*, 1913, No. 3, denoting the pre-war output of crude sugar per

(1) See *B.* 1922, No. 579. (*Ed.*)

hectare of beet in the different European countries, Germany standing first with 4613 kg. The author draws a comparison with the yield of sugar from Java cane : i. e. about 10 000 kg. per hectare.

In order to test the maximum quantity of sugar obtainable from beets under present conditions, experiments have been in progress (1920-22) in France which can be compared with pre-war totals. The data collected from 10 different farms and referring to a selection of varieties of beets, show the yield of roots per hectare the sugar content and the maximum and minimum production of sugar. These figures represent normal conditions and it may reasonably be expected to obtain an increase under more favourable circumstances. The author discusses the factors having most influence on yield, soil, cultural methods, manures, etc. The estimation has frequently been misjudged owing to lack of thoroughness as regards thinning out and lifting and consequent uneven spacing.

Experiments were undertaken on the Vilmorin Estate (Verrières), to study the average yield under improved conditions. Farmyard manure was applied at the rate of 30 000 kg. per hectare at the first ploughing (1921) and artificial fertilisers per hectare : 570 kg. superphosphate, 220 kg. nitrate ; 100 kg. potassium chloride. The second ploughing was effected in April 1922 and sowing in May followed by cultivation, thinning, and two subsequent hoeings and final lifting in October. Every three weeks from the August 7 onwards, samples of 25 beets from 21 individual plots were carefully lifted, cleaned, and analysed. The results were as follows.

Average weight of roots 721 gm. ; saccharine content 18.8 % ; sugar 136 gm. ; number of roots per hectare 69 150 (allowing for final thinning) ; yield of roots per hectare, 49 800 kg. ; sugar per hectare 9 400 kg.

Although it is only possible to draw approximate conclusions from these results, which will doubtless differ according to conditions, they form a basis on which to work and by further experiments it is expected to establish a definite standard. M. L. V.

85. **Loss of Sugar during Storage of Sugar Beets and Time for Testing.**

Pack, D. A. (Sugar Plant Investigations, Bureau of Plant Industry U. S. Department of Agriculture). Time for Testing Mother Beets. *Journal of Agricultural Research*, Vol. XXVI, No. 3, pp. 125-150, tables 6. Washington, D. C., 1923.

In the investigations carried on during the past three years at Salt Lake City station (Utah, U. S.), irregularity has been noted in the quantity of sugar-lost by individual sugar beets during storage. Under ordinary silo conditions for three months, the loss has varied from 1 to 8 %. This irregularity applies also to beets stored under controlled moisture and temperature conditions. It has been the usual practice to test sugar beets in the spring after winter storage and the author draws attention to the fact that failure to recognise these variations between sugar beets at harvest time and after storage has probably led to confusion in selection of desirable strains of beets for future breeding work.

Tests to ascertain the correct time for testing the mother beet were

made by the U. S. Bureau of Plant Industry using the ordinary silo for storage purposes. The beets were weighed and tested before and after 98 days storage. A full chemical analysis was made and records indicated the percentage of sugar for autumn and spring tests and the existing difference. Correlation tables show the actual percentage of sugar in beet and the loss during storage. It appears that those with an original high sugar content tend to lose to a larger extent during storage than those with a low content. As it is the custom for sugar beet factories to cut these beets at harvest or after an average of 40 days storage, it appears that strains selected for breeding purposes should be considered on the basis of autumn rather than spring tests. It is advised, however, that the plant breeder should record results of both these tests and also the conditions under which stored. M. L. Y.

86. Coffee Cultivation in Belgian Congo.

MERTENS, M. (Directeur de la Station agricole de Lula (Stanleyville). Culture du Café, Rapport technique et économique. *Bulletin Agricole du Congo Belge*, Vol. XIV, Nos. 2-3, pp. 371-392. Brussels, 1923.

General description of the outlay, upkeep, yield and trade value of coffee in the Lula district of Stanleyville (Belgian Congo). A comparison is made between the production of different varieties of *Coffea* and the seed distribution. M. L. Y.

87. Tea Cultivation in the State of São Paolo Brazil.

LOHAMANN, C. Cultura do chá, no Estado de São Paulo. *Boletim da Directoria de industria e commercio*, Year 14, Series a, Nos 3-4, pp. 49-55. São Paulo, 1923.

Report made to the Minister of Agriculture by the author giving an account of his travels is the State of São Paulo for the purpose of studying the cultivation and preparation of tea.

Tea-growing in this State dates from the beginning of last century, the seed used having probably come from the Rio Janeiro Botanic Gardens. In 1852, the total production of the State was nearly 30,000 kg., viz., about one-tenth of the present consumption, and there were already 30 agricultural tea-factories in various municipalities (Itu, Capivary, Piracicaba, Porto Felix, São Roque, etc.). Afterwards tea production decreased owing to some extent to the preference shown for coffee and to the abolition of slavery but chiefly in account of the poor quality of the product which was much inferior to Assam tea. Since there is no doubt that the country is suitable for tea cultivation (which would be more profitable than coffee-growing), all that is necessary is to use selected seed from the best centres of production. The whole district, from Mogy das Cruzes to São Roque, and from Parnhyba to Jundiahy, which is almost useless for coffee, would be very suitable for tea. The chief centre of production at present is Mururaby, but the crops now amount to barely one-fifth of those in the middle of last century. In many places, there are still plants

growing in the old tea-gardens which shows how well they have become acclimatised. F. D.

88. Tobacco Growing in Sumatra.

PAZUIRIGAN, H. B. (In charge of Tobacco Investigations). *The Tropical Agriculturist*, Vol. LXI, No. 5, pp. 266-271. Peradinya, Ceylon, 1923s

The tobacco industry in Sumatra is highly specialised, as there are planters only — no factories nor brokers — and the planters' work is directed to the production of wrapper leaves only, which after fermentation are baled and shipped to Europe.

Tobacco is grown on the northern half of the east coast of the island on the plains facing the straits of Malacca, where the temperature averages 27°C. throughout the year, with a maximum of about 33° and a minimum of 21°C., and with a fairly evenly-distributed rainfall of from 80 to 120 inches.

System of Farming. Large estates are the rule, with an average of 75 000 acres, of which only 750 acres on each estate are planted yearly with tobacco the rest of the land lying fallow for seven or eight years.

Seed Beds. These usually measure 4 by 20 feet, well raised to insure drainage, and shaded with cheese cloth or leaves supported on a light framework. After about ten days the shade is partially, and afterwards, entirely removed.

Insect pests are checked by the use of arsenate of lead and the vigilance of the coolies.

About 50 days after sowing the young plants are ready for transplanting, which takes places from the end of February to June. The seedlings are planted in alternate rows 3 and 1 ½ feet apart, the distance apart of the plants in the rows being 1 ⅓ feet. Cultivation is carried out about a month after planting, again about two weeks later, and the last cultivation when the plants are about 3 feet high. Fertilisers are rarely used unless the plants do not thrive, when a small quantity of guano, wood-ashes or cotton-seed meal is applied.

The plants are generally suckered and topped.

Diseases and Pests. The common tobacco fungous diseases are met with, but the tobacco wilt only, caused by *Bacterium solanacearum*, is important. Insect enemies are controlled by means of lead arsenate in the form of powder, also by the hand collection of worms. Harvesting is carried out about two months after transplanting, and is finished by the end of May or June. A special feature is that only two leaves at a time are collected from each plant, at intervals of two days, and these leaves are divided into four classes, lowermost, lower standard, upper standard and top.

Curing. The typical drying shed is built of light material and measures 180 ft. in length, 72 in width and 32 in height. The sides are almost entirely formed of windows and doors, in order to control conditions during curing. A shed of these dimensions will take the leaves from about 50 000 plants. Fifty leaves are strung, back to back and secured to a slender

pole, these poles being hung on racks 5 or 6 ft. apart. The curing process lasts from 20 days to 2 months.

When the leaves are thoroughly cured they are transferred to the fermentation shed where they are placed on a low platform in piles from 4 to 6 ft. high, the different classes of leaf being kept separate. The characteristics of a wrapper leaf which it is desirable to bring out are, an even light colour, glossy appearance, and elasticity. At first the heat generated is allowed to reach 38°C., after which the pile is rebuilt, and then it may attain as much as 53°C. The piles are rebuilt until the leaves show the desired qualities.

After fermentation the leaves are strictly classified according to size, region, i. e. the part of the plant from which the leaf was picked, colour, and soundness.

When classified the leaves are placed in bundles of 35 or 40 each, ready for pressing and baling. Bales of Sumatra tobacco are of uniform size, 30 × 30 inches, by 9 to 12 inches in height, according to the size of the leaves. W. S. G.

89. **Chemical Investigations of Three South African Medicinal Plants.**

Du Plessis, I. P. J. *The South African Journal of Science*, Vol. XX, No. 1, pp. 256-264, bibliography. Johannesburg, 1923.

The author refers to earlier investigations made in connection with poisonous and medicinal plants in South Africa, but considers that insufficient attention has been given to the question and urges the need for systematic work of a more definite nature. This is more readily emphasized by the numerous problems concerning human and stock diseases peculiar to the country. Preliminary investigations have therefore recently been made at the University of Stellenbosch with three plants hitherto unexploited, with the idea of establishing a basis on which to carry out further analyses:

1. *Dodonea Thunbergiana* E. and T. Natural Order Sapindaceae; found in Western Province (Cape), in all districts with a moderate rainfall; use medicinally as a tonic and purgative; bark decoction used as a remedy for consumption. The leaves were thoroughly examined and results indicate presence of saponin; trace of alkaloid; lack of volatile oil; ready solubility in hot water.

2. *Eriocephalus umbellatus*, U. C. Natural Order Compositeae ("wild rosemary"), found in Western Province. When steam distilled separately the leaves yielded a larger quantity of essential oil, slightly more yellow and mobile than that from the seeds and flowers. The total yield was 0.1 cc. (less than 0.2 % of the green leaves) of light yellow oils with sharp but not unpleasant aromatic odour (similar to terpenes) and a burning taste. The oil gradually darkens on exposure to light, probably due to polymerisation. Specific gravity of freshly distilled oil, 0.954 at 15°C.; refractive index 1.503.

3. *Sphenogyne abrotanifolia* R. Br. Natural Order Compositeae, found on Paarl Mountain (Cape); tinctures in brandy used medicinally of the whole

plant or leaves) when steam distilled, the oil from the leaves had a much stronger terpene odour than that from the stalks and gave about four times the quantity compared with the latter. The yield of oil calculated on weight of leaves distilled was 0.58 % (6170 gm. leaves gave 40 cc. oil, specific gravity 0.914).

M. L. Y.

90. Mechanical Cultivation of Mint.

FONDARD, L. (Directeur des Services agricole des Bouches-du-Rhône) and AUTRAN, E. (Propriétaire-agriculteur à Annot B.-d.-R.) *La petite Revue agricole et horticole*, Year 29, No. 684, pp. 138-139, fig. 1. Antibes, 1923.

The authors have studied the methods to be adopted in the mechanical cultivation of mint. Their experiments were conducted with a view to deciding questions relating to : the spacing of the rows, depth of planting, moulding up soil, cutting the rhizomes.

Spacing of the rows. — The best distance between the rows was found to be 60 cm., as this allows planting, hoeing and moulding up to be effected by a specially mounted horse-hoe. The returns were the same as when the rows were planted closer together.

Depth of planting. — It is generally thought that mint plants should only be covered with about 2 cm. of loose soil. This rule cannot be followed if a horse-hoe is used, but the authors have found that mint rhizomes take no hurt if covered by 2 to 5 cm. of soil which makes it possible to dispense with hand-hoeing.

Moulding up. — The results obtained by the different treatment of the 3 plots were as follows :

1) Control plot, not moulded up, average growth ; 2) a little moulded up, development fairly good ; 3) much moulded up, the plants grew thicker and taller than in the case of the other two plots.

Cutting the rhizomes. — The rhizomes of mint bear cutting very badly. If the rhizomes are 2-3 cm. long the plant grows unsatisfactorily, only reaching a height of 7-10 cm. Rhizomes cut back to 7-8 cm. produce irregularly-growing plants ranging from 25-30 cm. in height. When the rhizomes are left entire, the plants grow to 40-45 cm.

Cost of cultivation. — The data summarised in the appended table show that it is possible to obtain a profitable crop by mechanical cultivation.

Comparative Cultural Data for one Hectare of Mint.

	Hand cultivation	fr.	Machine cultivation	fr.
Clearing and preparing the ground.	50 man days at 15 fr.	750	3 days ploughing at 50 fr 1 day harrowing and rolling	150 50
Planting	30 man days at 15 fr. 60 woman days at 5 fr.	450 300	1 ½ horse days at 20 fr. 10 man days at 15 fr. 28 woman days at 5 francs	30 150 140
2 Hoeings	20 man days at 15 fr.	300	2 days horse hoeing at 35 fr. 10 days woman's labour, second hoeing at 5 fr.	70 50
1 Moulding up	10 man days at 15 fr.	150	1 day hilling up with hoe	35
Cutting	with sickle 15 days at 15 fr.	225	1 day's work with reaper	40
Expenses not connected with machine cultivation.				
Value of plants:				
Rent of ground		200		200
Fertilisers	600 kg. superphosphate 250 kg. ammonium sulphate 200 kg. potassium sulphate 100 kg. sodium nitrate.	625		625
Pulling up plants	10 man days	150		150
Carriage of crop	15 000 kg. at 1 fr. per 100 kg.	150		150
	Total expenses	3 300	*Total expenses*	1 840
Value of crop at price paid at Grasse, in 1922, 20 fr. per 100 kg. × 150		3 000		3 000
	Loss	300	Profit	1 160

F. D.

91. The Utilisation of *Pleurotus Eryngii*.

COSTANTIN, J. Utilisation du *Pleurotus Eryngii*. *Comptes rendus des séances de l'Académie d'Agriculture de France*. Vol. 9, No. 37, pp. 915-916. Paris, 1923.

The author is of opinion that land which has gone out of cultivation, fallows, waste tracts, dunes and even forests could be rendered very profitable by cultivating fungi. Mention is made of information received

from the Société d'Horticulture de la Charente-Inférieure (France), respecting the Blue thistle and its parasitic *Pleurotus*. In this district, all the peasants collect *Pleurotus Eryngii* in preference to other fungi and it has become an article of trade. F. D.

Horticulture.

92. Ancient Types of Lettuce.

GÉRÔME, J., Notes sur divers types anciens de laitue. *Journal de la Société Nationale d'Horticulture de France*, Series 4, Vol. XXIV, pp. 379-384. Paris, 1923.

The author's remarks on different ancient types of lettuce refer to: 1) plants cultivated under the name of oak-leaves lettuce; 2) lettuces of Asiatic origin, " diep-ngo ", on-sen ", o souné etc.; 3) variations of the oak-leaved lettuce (spinach lettuce, curled lettuce etc.). Some of them are ancestral forms derived from *Lactuca Scariola*, while others are modifications of the ancestral types owing their variation to several factors such as climate and different, conditions of environment and cultivation F. D.

93. Strawberry Planting.

PETIT, A. (Professeur à l'école nationale d'horticulture de Versailles). Plantations des fraisiers. *Revue Horticole*, Year 95, No. 24, p. 541. Paris, 1923.

The author planted out runners of the " Docteur Morère " variety of strawberry during the first fortnight of August. The plants in one plot were left in the ground, but those of the second were lifted in the autumn and transplanted finally in October. In the case of the third plot, the strawberries were transplanted in October, and again in the following March.

The plants grew less the more they were moved; the weight of fruit obtained from the 30 individuals was respectively:

1) Untransplanted strawberry plants . . . . . 3.945 gm.
2) Plants moved once, in the autumn . . . . . 2.667 »
3) Plants transplanted at the end of winter . . . . . 2.053 »

The heaviest crop fetched the best price on the market, as the fruits were the largest and the finest

Planting out the runners at once is the most economical method of growing strawberries and insures the best yield R. D.

94. The Exportation of Pine-Apple Seedlings.

MONTANO, J. Los hijos de piña. *Agricultura y Zootecnia*, Vol. II, No. IX, pp. 373-374, tables 2. Havannah, 1923.

The author expresses his approval of an Act forbidding the exportation from Cuba of pine-apple seedlings, for owing to the high prices fetched by these plants, their exportation had reached proportions that threatened the pine-apple growing industry of the island. J. P. C.

95. **Transplanting large Palm-Trees.**

DENTAL, J. B. (Horticulteur paysagiste). L'horticulture sur la Côte d'Azur Transplantation de gros palmiers au Cap d'Antibes. *Revue Horticole*, Year 95, No. 24, pp. 537-539, figs. 4. Paris, 1923.

The author has succeeded in transplanting large palms of the *Pritchardia* variety on the Côte d'Azur (France). The trees were over 9 metres in height, and in some cases, weighed more than 7000 kg. A description is given of the method of transplanting. R. D.

Arboriculture.

96. **Super-Grafting. Effect of the Scion on the Stock.**

PASSY, P. *Journal de la Société Nationale, d'Horticulture de France*, Series 4, Vol. XXIV, pp. 461-464. Paris, 1923.

I. — Super-grafting consists in applying another fruit-bearing graft to the first scion inserted in the stock. The resulting individual is thus formed from the : *a)* stock which supplies the root system ; *b)* the intermediate stem ; *c)* the scion forming the fertile crown.

This method of grafting is adopted in the nursery in order quickly to get rid of a bushy, thorny individual and obtain a more shapely tree. The pear-tree when growing on its own roots, is bushy and has a number of thorny branches. If during its second, or third year in the nursery, a shield-graft is made with a scion from a vigorous thornless variety of pear, a straight stem is produced upon which the fruit-bearing variety can be grafted : in this way, the nurseryman disposes of a troublesome tree and saves time. Pear-trees growing on their own roots are very dissimilar and would produce plots lacking in homogeneity, this can however be remedied by shield-grafting ; a scion producing a fine stem should be inserted in the stock while it is still very young.

Super-grafting has also been recommended for imparting vigour to weakly varieties : it is especially advisable when low-growing espaliers are required. A vigorous scion is grafted on the quince, and in the autumn, of the first year, shield-grafts of the delicate variety are inserted in the first scion at about 30-40 cm. from the ground. In this manner, the strong-growing intermediate graft is reduced to some centimetres of wood which bear no leaves and thus seem to exert no influence upon the fruit-bearing scion. It is, however, well-known that some varieties of pear do not graft well on the quince, although the grafts take satisfactorily if another tree is selected for the stock. Therefore by the process of intermediate grafting, its is possible to grow upon the quince a variety that ought to have been grafted on a stock growing on its own roots.

Instead of inserting the fruit-bearing scions at a height of 40-50 cm. from the soil and thus at once suppressing the vigorous variety, the first change in the tree may be obtained from the latter which can be allowed to make 1-1.50 m. of wood. Owing to its special properties, this strong-growing graft will cause the stock to develop and strengthen its root-

system, so that when the delicate variety is grafted at this height, the tree will have already acquired a vigorous growth from which the scions will benefit.

II. — As regards the possibility of the graft exercising a direct action upon the root-system of the stock, the author states that, at all events at the beginning, the effect of the graft is easily recognised when the pear is grafted on the quince. It has been found that if, on the same plot, varieties of pear with scions that hardly ever branch to a great extent such as *Beurré Hardy*, *Doyenné du Comice* and *Curé*, are grafted on varieties producing many branched shoots like *Doyenné d'hiver*, *Beurré d'Hardenpont*, the root-system of the varieties with unbranched grafts is poorly developed, whereas in the case of those with much branched shoots, the number of roots is much larger and the rootlets do not penetrate as deeply into the soil. R. D.

97. **Establishing Tree Identities in *Citrus* Groves.**

The Florida Grower, Vol. XXVIII, No. 25, p. 5 and p. 15. Tampa, Florida, 1923.

Frequently there are too many trees in a citrus grove that are not good producers. The following practical method of identifying individual trees is described. Two numbers are fixed to the tree, painted with a thick mixture of linseed oil and white lead, keeping definitely to one side of the tree and at equal heights. The upper number indicates the row and the lower the tree number. Records should be kept of the condition of each tree, treatment etc. It is noted that if equal care were given to sorting of inferior citrus seedlings as is given in the sorting and packing house, there would be far more uniformity in the size of trees in groves, and increased production. When seedlings have reached a height of 2 inches they should be lifted and graded. Usually one-fourth of the plants need to be discarded. M. L. Y.

98. **Influence of Soil Type on the Yield and Quality of Pecans *(Carya oliviformis)*.**

Skinner, J. J. (Office of Soil Fertility Investigations, Bureau of Plant Industry, U. S. Dept. of Agriculture). *Journal of American Society of Agronomy*, Vol. 16, No. 1, pp. 51-57. tables 3. Geneva N. Y., 1924.

As a result of the variations in yield, size and quality of pecan nuts (*Carya oliviformis*) grown on different soil types in the Southern States (U. S.) investigations were made to study the comparative effects of these differences. The modern pecan industry has been developed on the loams and sandy loams of the upper coastal plains of Georgia, Florida and Alabama and the experiments were conducted in these areas.

According to the results obtained, the hydrogen-ion value of the soil had a distinct influence on both size and quality. This applies also to the proportion of organic matter and nitrogen. From the data given

for the different varieties and localities tested, the following have been selected for comparative purposes :—

Influence of soil on size and quality of Schley pecan grown on two soil types in Alabama.

	Soil Composition			Number Nuts per pound	Average weight of nuts	Diameter in 64th inch	Length in 64th inch	Meat	Protein in kernel	Sugar in kernel	Oil in kernels
	Carbon	Nitrogen	Hydrogen-ion value								
	%	%			gr.			%	%	%	%
a) Sandy loam 1 . . .	1.6	0.059	5.8	60	7.5	54	118	61.4	11.6	2.6	78.5
b) » » 2 . . .	1.4	0.057	6.4	67	6.8	52	110	59.8	11.0	2.5	78.2

M. L. Y.

99. Status of Nut Culture in the United States and Canada.

NEILSON, J. A. (Ontario Agricultural College). *The Agricultural Gazette of Canada*, Vol. X, No. 4 pp. 323-330. Ottawa, 1923.

Description of the distribution and characteristics of the nut trees of native origin and introduced species, including *Juglans* spp., *Carya* spp., *Castanea* spp., *Corylus* spp., *Fagus grandiflora*, *Prunus amygdalus*. Suggestions are made with reference to suitable positions for planting nut trees and the choice of varieties. M. L. Y.

100. Dates and Date Cultivation of the Iraq.

DOWSON, V. H. W. *Agricultural Directorate Ministry of Interior Mesopotamia, Iraq. Memoir III*, pp. 1-97, pl. 54 + map, bibliography. Cambridge, 1923.

This report chiefly deals with the varieties of date in the Shat Al'Arab district. A detailed list of 48 female varieties is included with observations on the male species which are, however, not numerous. The most common male variety is the Khikri; a vigorous grower, and easily distinguished from the surrounding females, by its height, breadth and number of leaves and spines, much more abundant than on the female palm.

Details are also given as to the distribution and classification, and a list of the varieties found in different countries (Morocco, Algeria, Tunisia, Tripoli, Egypt, Sudan, Cyprus, Arabia, Persia, India, United States, Australia). The work is well illustrated and a complete bibliography is included. M. L. Y.

(1) For summaries I and II dealing with this subject see R. [illegible] and 1[illegible] respectively (*Ed.*)

101. **Some interesting Facts about Bananas: A World-wide Review; Scientific and Practical Information.**

HARRIS. T. S. *The Fruit World of Australasia,* Vol. XXIV, No. 12, pp. 438-440 figs. 1. Melbourne, 1923.

A brief survey of the general structure, habits and distribution of the banana plant and its introduction into various countries followed by a full description of the important commercial variety *Musa cavendishi* ("dwarf banana"), and the packing for transport. Methods of propagation are described and reference made to the reproduction from seed grown in Jamaica, and subsequent cross-pollination with the resulting plants. M. L. Y.

102. **The Cultivation of the "Umbuzeiro" *(Spandias tuberosa).***

BOMFIN, U. (Inspectoria Agricola Federal do Estado de Bahia). Cultura de Umbuzeiro. *Chacaras e Quintaes,* Vol. XXVI, Part. 2, pp. 116-117, fig. 1. São Paulo, 1923.

The author gives directions for the cultivation of *Spandias tuberosa,* an arborescent *Anacardiacea* growing wild in the arid soils of the States of Bahia, Pernambuco, Alagoas, Sergipe, Rio Grande do Sul, Ceará, etc. The farinaceous tubers formed by the roots of this plant are used for human food, as are also the fruits of which a healthy tree produces on an average 400 to 500 kg. The juice of the fruit is used into different articles of food and beverages and when concentrated at a low temperature forms the so-called "vinho de umbu" which might supply a considerable industry. This juice is also employed in the manufacture of vinegar.

The author advises the tree being grown from cuttings rather than from seed.

So far, no parasite of *Spandias tuberosa* has been found.

F. D.

103. **The Breadfruit, its Cultivation and Food Value.**

PIERAERTS, J. A propos de l'arbre à pain. *Bulletin Agricole du Congo Belge,* Vol. XIV, Nos. 2-3, figs. Brussels, 1923.

A review of the advantages of the bread fruit (*Artocarpus incisa*) from the cultivation and nutritive standpoints. The author refers to several analyses made recently and compares the nutritive value with that of banana and manioc, indicating the high percentage of carbohydrate and the relative deficiency in vitamines. Reference is made to the "rimier" (*Artocarpus incisa* var. *seminifera*) which is popular in the Belgian Congo and although of less importance as compared with the real bread fruit should not be neglected. Recommendations are made as regards extended cultivation of the bread fruit in the Congo and utilisation for manufacture of bread, biscuits, etc. M. L. Y.

Forestry.

104. Forest Fires

I. — SEURRE (Inspecteur des Eaux et Forêts). Assurance des forêts contre l'incendie. *Bulletin du Comité des Forêts*, Year 10, No. 20, pp. 162-167, Paris, 1923.

II. — DE SAINT POL, J. and RIVES, P. Les incendies de bois. *Ibidem*, pp. 167-181.

III. — WOOLSEY, T. S. (Consulting Forester). Fire Damage Claims in New England Estates, *Journal of Forestry*, Vol. XXI, No. 1, Washington, 1923.

IV. — AVORT, P. Incendies des bois. *Bulletin de la Société Centrale Forestière de Belgique*, Year 30, Part. 2, pp. 70-83, Brussels, 1923.

V. — Projet de Loi concernant les incendies en forêt. *Bulletin du Comité des Forêts*, Year 10, No. 20, pp. 181-101. Paris, 1923.

VI. — RIVIÈRE, G. (Directeur de la Station Agronomique de Seine-et-Oise). PICHARD G. Influence de la couleur des murs d'espaliers sur la hativité de maturité des fruits des pêchers qui y sont adossés. *Journal de la Société d'Horticulture de France*, Series 4, Vol. XXIV, pp. 79-82, Paris, 1923.

I. — INSURANCE OF WOODS AGAINST FIRE. — In France, woods of deciduous trees are insured under the following separate heads: 1) Coppices; 2) reserves (young trees and seedlings), 3) suckers (shoots that have grown out of the trunks); 4) administrative losses (decrease or loss of returns); 5) injuries due to neighbours.

The French Companies do not insure the dead débris covering the ground, and often object to insuring suckers and against administrative injuries. At the present time, they ask the following premiums:

a) Coppices over 25 years old: 1.25 fr ‰ without any distinction as to kind of tree. Coppices less than 25 years old, 1.50 fr ‰ without any distinction as to kind of tree. Nurseries and plantations of less than 15 years of age 3 ‰.

Since nearly all the coppices are felled every 25 years, the premium of 2.5 ‰ on the wood capital is too high, so the owners do not insure them.

In the case of resinous trees, the French companies draw no distinction between woods of spruce and pine respectively; their tariff is as follows: woods over 50 years of age 3 ‰ — of 30 to 50 years 5 ‰ — of 10 to 30 years 10 ‰ — 10 years of age 15 ‰. The spruce woods are in the mountains, viz., on land that is generally damp and has an irregular surface where naturally there is little fear of fire spreading. In addition, very often underwood is absent owing to the prohibitive premium placed on it.

II. — FOREST FIRES. — The "Comité central agricole de la Sologne" has devised a method of facilitating the assessment of damage by fire both as regards the estimation of the losses entailed and of the indemnity to be paid. The author gives the following definitions:

The commercial value of the forest timber is the price it would have fetched just before it was destroyed by fire.

Its relative value (*erga dominum*) is the value it had on the eve of the fire for its owner, who would have sold it for a known, or supposed, price at a given date in the future.

The direct, or absolute, estimate includes the value of the wooded land and of the timber it bears.

The relative estimate is that of the returns based on an arbitrary assessment, or given by the absolute estimate. It is used in the case of coppices, or for fine-woods with short term of felling.

The fundamental principles on which this method is based are as follows : Since the person who has suffered the loss and the author of the fire are not bound by any contract, the injured owner ought to be restored to this original situation as regards returns, stock and the sum invested. The trees destroyed must be estimated at their *erga dominum* value, that is to say, on the basis of the condition of the wood at the time it was destroyed. In fixing the indemnity, it is necessary to take into account:

1) the future value (of which the amount will be determined from the absolute estimate) ; 2) the annual amount of timber cut ; 3) the sum to be written off for timber of inferior quality, extra management expenses, or loss by forced sale ; the value of the dead débris (it is reckoned that each quintal of leaves and detritus represents a loss of 1-2 kg. of nitrogen which must be paid for at the current rate on the day of the fire. This special compensation can also be estimated from the loss of value of the following fellings). The basis prices to be used in calculating the future value and the assessment rate are the average prices of the last 10 years ; the prices quoted for the salvage material are the present prices minus the depreciation due to various causes.

In the case of pine woods, it is necessary to take the future value into account until the trees have reached the age when their commercial value is equal to their future value. This is about 30 years in the case of *P. maritima* felled at 40-45 years and about 40 in that of *Pinus sylvestris* felled at the age of 70. As soon as the experts are agreed upon this age, as well as upon the age of the trees at the final felling and upon the assessment based on the absolute estimate, the ordinary methods of calculation are applied, the thinnings effected previous to the accident, and the cost of replanting after felling being taken into account.

If these calculations are accurately made for pine-woods of different ages and types, the coefficients required for the multiplication of the commercial value at the time of the fire can be obtained.

Whatever the age of the destroyed pine-wood, replanting is necessary, and the owner would in any case have had to incur this expense as soon as the trees were felled, therefore the indemnity to be paid is the difference between the present cost of replanting and the interest that would have accrued on that sum if the pine-wood had been felled at the appointed time.

In the case of coppices, the indemnity represents the future value of the burnt woods (determined according to the relative estimate), to which must be added the cost of felling the trees, after deducting the re-

turns from the salvage timber. If the coppices are grown in rotation and the owner wishes to preserve the rotation, the indemnity will be the difference between the returns from trees that have reached the normal end of the felling term and those from the younger stands replacing them; the calculation must be made right up to the day of felling. Since coppices always suffer from the effect of fires, this must be remembered in view of replanting and of the suceeding decrease in the yield for at least two or three fellings.

In the case of reserve coppices, two categories must be made according to the general conditions and to the severity of the damage. In the first, which includes trees to be felled, it will be necessary to determine: 1) depreciation due to forced sale and inferior quality; 2) depreciation due to premature felling (deducted from the commercial value at the normal age for felling). In the second category, which includes any trees that may be left standing, it is necessary to assess a depreciation proportionate to the injury caused by retarded growth.

The same must be done in the case of isolated trees. Special compensation is granted for the game.

Rives gives two numerical examples of the application of the preceding rules.

Take a pine-forest felled when the trees are 60 years old, which is to be thinned at the ages $t_1\ t_2\ t_3\ \ldots\ldots\ldots$ which would yield a_1, a_2, a_3 francs. Let us suppose that this pine-forest was burnt at the age of t_1 immediately after the products of the first thinning had been removed. The loss incurred calculating it at 5 %, and at the moment of the fire, would, be

$$A_2 \frac{1}{1.05\ t_2-t} + A_3 \frac{1}{1.05\ t_3-t_1} + \text{———}$$

If n be, the chief felling (at 60 years) that would have produced a_n. This is $\left(a_n - \frac{R}{2}\right) \frac{1}{1.05\ n-t_1}$ where R is the expenses of the replanting supposing the pine-forest to be productive at the age n (60 years) and able to supply half the seedlings estimated at R.

The depreciation D therefore rises to:

$$D\ E\ a_2 \frac{1}{1.05\ t_2-t_1}\ t\ a_3 \frac{1}{1.05\ t_3-t_4} + \text{———}$$

$$\left(a_n - \frac{R}{2}\right) \frac{1}{1.05\ n-t};$$

to D must be added the expenses of immediate replanting R and the expenses of further replantings between a number of years $n-t$, since a pine-forest of that age supplies no seedlings, or at any rate, these cannot live under the layer of loose detritus. As half this expense has been

calculated, it only remains to estimate the other half $\frac{R}{2} \times \frac{1}{1.05\ n\text{-}t_1} = r$. Therefore the total damage is $D\ tR + r$.

It is necessary to deduct the sum realised by the sale of the timber still left in the burnt forest : from the thinnings to be made from A_1 and from the definitive felling to be carried out in $n\text{-}t_1$ years, this can be ascertained by methods similar to those already described.

Suppose a coppice to be felled every 25 years is burnt after 25 years and 6 years respectively. At the age of 25 years, it would produce timber of the value of 400 Lire. The capital producing 400 Lire every 25 years is at 3 % $F = 400 \frac{1}{1.03\ 25\ n\ 1^0}$. The felling-timber destroyed by the forest being burnt after 6 years has a value $x = F\ (1.03^6 - 1)$. The loss sustained is found by adding the felling expenses to x and deducting the trees that have been saved (the products of felling).

The author then carefully explains how the owner whose property has been injured is to fix the amount of compensation due in the three following cases : 1) where the author of the fire is unknown, but the owner is insured ; 2) where the owner is not insured, but the author of the fire is known ; 3) where the owner is insured and the author of the fire is known.

III. — Fire damage claims on New England Estates. — In the case of a forest that can produce in 60 years, timber to the value of 60 dollars, the indemnity paid would be 10.27 dollars, if the rate of compensation were 4 % and the forest was burnt after 15 years, provided only the future value of the trees is estimated. The author, however, considered the legal aspect of the question in the case of Connecticut.

Railway Companies must give compensation for all damage due to forest-fires for which they are responsible. The damage is therefore assessed from the difference in value of the forest before and after the fire respectively. In other words, the amount of compensation is found by subtracting from the value of the forest before the fire the sum necessary for restoring it to precisely the same condition it was in before it was burnt. In the first place, the injury done to the trees must be assessed. In order to replace the dead trees, it is necessary to cut down them down ; therefore both the cost of felling and the original value of the trees must be taken into account. When any of the trees are still salable, the price they will fetch should be credited to the Company. The destruction of the underwood and of clearing the detritus must also be reckoned, as well as the replanting expenses. On the other hand, the owner has to wait until the newly planted trees reach the age of those that were destroyed, the loss thus entailed is indemnified by a sum representing the interest of the inproductive capital. In addition, the owner should receive some compensation from being deprived of the pleasure he would have derived from his forest.

Let us now consider the case where the forest was entirely destroyed, but was not salable. Supposing the owner had paid 100 dollars for the wooded land, that the fire broke out after 15 years, the pre-

miums at 4 % compound interest amounted to 6 dollars for 15 years, and the removal of the detritus cost 20 dollars, the indemnity would be :

Compound interest at 4 % for the cost of the wooded land for the years	80.09 dollars
Premiums at 4 %, compound interest	6.00 »
Total	86.09 dollars

These 86.09 dollars now represent 47.80 dollars to which we must add 20 dollars for clearing ; this makes 67.80 dollars to be paid to the owner in order to restore his forest to its original condition, whereas the mere estimate of the future value would only have given 10.27 dollars.

The damage can be assessed in another manner. If the forest had been felled under normal conditions immediately after the time at which the fire occurred, it would have had a certain total value ; the damage done must therefore be determined by finding the residual value after the fire and the value immediately before the fire. This estimate is however very difficult to make, since there is no secure basis upon which to calculate the value of the forest after the fire.

IV. — Forest fires. — Avort describes a system of mutual insuraance against forest fires. He suggests the premium being gradually reduced as the insured areas increase and advocates the assessment of the damages by an expert. The premiums proposed are as follows : *Areas not exposed to danger* : coppices 65 % ; conifers 1.75 %. *Areas exposed to danger* : coppices 0.75 % ; conifers 1.96 %. An additional premium of 15 % for coppices and of 10 % for conifers must be paid for insuring forest classed as " badly managed ".

V. — Bill for the control of forest fires. — Owing to the increased damage due to forest fires in France, an expert Commission was appointed in 1922 to study the question and devise some scheme for limiting the number of forest fires as far as possible and controlling them when they break out. Legislative measures have been taken to promote :

1) More rigorous action on the part of the Authorities in order to enforce greater care in the use of fire.

2) The education of the public with a view to more care being taken.

3) The systematic control of forest fires by means of rapid notification (by observatories, aerial craft and different methods of signaling) so that competent persons may at once proceed to extinguish the flames with the aid of proper appliances kept in special dépôts.

4) The construction of protective works (isolating roads, fire-screens, water-reservoirs, etc.).

Other provisions are directed to the amendment of the existing legislation in certain points that are specified by the bill from which an extract is given.

Art. 1. — During certain periods of the year for a time not exceeding 5 months, the prefects shall be empowered by the Forestry Inspector (*Conservateur des Eaux et Forêts*) to : 1) forbid the owners or holders of forest-land to light any fires in the forests and within a radius of 200 m., or to impose certain restrictions upon the use of fire both within the forest

and within a 200 m. radius ; 2) regulate the burning of standing plants within at least 400 m. of woods, or forests ; 3) forbid all persons smoking in woods or forests, or carrying certain species of matches or similar incendiary matters when walking in woods or forests.

Art. 2. — The prefects shall have the power to prolong the closed season for all kinds of game throughout the whole, or any part, of the forest area should there be any danger of fire.

Art. 3. — In the case of fires in woods, or forests, not under the supervision of the Forestry Authorities, grazing may be prohibited throughout the whole, or part, of the burnt area for a certain period that may be extended to 10 years.

Art. 4. — Syndicates may be formed with the object of creating and directing fire-brigades for the control of forest fires and shall be empowered to purchase and maintain appliances for extinguishing fires in forests.

Art. 5. — Owners of forests situated in areas classified as being especially exposed to danger of fire obliged to form themselves into Syndicates for forest defence.

Art. 6. — Should the forests owners not have formed themselves into such Associations, the Prefect shall appoint a special Commission composed of the " Conservateur des Eaux et des Forêts » a Councillor-General, a representative of the owners and a representative of the workers.

Art. 8. — No compensation shall be given to forest owners for any destruction on the part of the syndicates of brushwood groving on isolation strips or plots of land, provided this destruction does not hinder the growth, or regeneration, of the forest stands properly so-called.

Art. 9. — Whenever woods, forests, or wooded land are situated within 20 m. of a railroad, the Railway Company shall have the right, after duly advising the interested parties, to cut down the brush wood along a longitudinal strip 20 m. in width as measured from the outside edge of the railroad.

Art. 10. — In case of forest fires, the direction of the fire control operations devolves upon the Mayor, or in his absence, upon the head of the regular local fire-control Service of a syndicate of forest-owners.

F. D.

105. **Forest Resources of the World.**

Zon, Raphaël, and Sparhawk, W. N. pp. 1000, coloured maps 16. *The Official Record*, Vol. II, No. 39, United States Department of Agriculture. Washington, D. C., 1923.

The growth of timber in the entire world is equal to only two-thirds of the amount consumed, and the world's timber supply is steadily shrinking. Such is the situation shown by the authors', who are economists of the Forest Service. The work contains statistics as to the extent and kind of forests ; cut, growth and consumption of timber ; ownership and legislation.

W. S. G.

106. **Acacias, and the Re-Afforestation of the Maures and the Estérel (France).**

MANGIN, M. (Inspecteur des Eaux et Forêts). *L'acacia decurrens* (var *normalis*) et le reboisement des Maures et de l'Esterel. *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. 9, No. 33, pp. 838-841. Paris, 1923.

The Australian varieties of Acacia with tanniferous bark, in general a nd especially *Acacia decurrens*, are calciphobous and prefer, loose, sandy-clay soils. The *melissima* variety which is richest in tannin has been planted on uncultivated land in Natal, but it needs good soil and cannot stand frost or extreme heat. The *dealbata* variety has the lowest tannin content and should therefore be discarded. *Acacia normalis* is the variety that best combines a fair percentage of tannin with resistance to slight frosts and excessive heat, further, it is not exacting as to soil.

In South France, *Acacia decurrens* and certainly *Acacia dealbata* thrive well. It would be advisable to replant the siliceous massif of the Maurés and Esterel, where many trees have perished as the result of fires, with young individuals of *Acacia decurrens* var. *normalis*, after they have been acclimatised in the most fertile and sheltered spots.

The re-occurrence of forest fires might be prevented to a certain extent by isolating the stands of resinous species that cover a large portion of the massif. R. D.

107. **Handbook of the Forest Trees of the Belgian Congo.**

VERMOESSEN, C. Manuel des essences forestières du Congo belge (Région équatoriale et Mayumbe). Coloured plates and drawings, 1 Vol. in 12mo, XII + 292 pages, Brussels, 1923 (Published by the Agricultural Department of the Belgian Colonial Ministry). Price 25 francs. Brussels, 1923.

The writer of this handbook, and the artist who designed the coloured plates, were sent to Africa in 1918 by the Department of Agriculture of the Ministry of the Belgian Colonies, for the purpose of collecting the information necessary for a book on the useful forest-trees of the Belgian Congo. The premature death of M. C. VERMOESSEN prevented his dealing with all the data accumulated, therefore the work has been published in an incomplete condition and only describes sixty species of trees. The coloured plates represent the branches bearing flowers and fruit, the scientific name of the species being appended in every case.

R. D.

108. **Timber Resources of Kenya, Uganda and Tanganyika.**

The South African Journal of Industries, Vol VI, No. 9, pp. 411-417. Johannesburg, 1923.

The timber resources of the world are steadily diminishing and although reafforestation is being carried out in many countries, a number of years must pass before the cutting stage is reached, hence the importance of data respecting new sources of supply. The following parti-

culars were obtained from the recent report of the delegation sent by the Government of South Africa to the above territories.

Kenya.

The forest areas of Kenya have been estimated at a total of 2 040 000 acres

Coast forests. — They are tropical and extend from the tidal mangrove swamps to a height of about 1200 feet On the higher ground, ebony (*Dalbergia melanoxylon*) and mbembakofe (*Afzelia quanzensis*) are found.

Ebony is procurable with stems up to 24 inches in diameter; the heartwood is hard and jet black.

Mbembakofe is a tree of large girth. The timber is heavy, hard, bright red and of even grain. Weight 55-56 lb. per cub. ft. Logs are obtainable in length up to 16 ft, and 17-18 inches square The timber is used for furniture, doors, etc

Plain forests. — At an altitude of from 5000-6500 ft, detached areas of forest are met with containing muhugu (*Brachylaena hutchinsii*), munderendu (*Teddalia* sp.) and muthiga (*Warburgia ugandensis*).

Muhugu attains a height of 80-90 ft. Timber light, brown, hard, easy to work, splits well, polishes, seasons easily, resists attacks of termites. Weight 58-60 lb. per cub. ft. Suitable for floor boards, parquet flooring, posts, etc., and also for railway sleepers. It is estimated that 1 000 000 sleepers could be obtained from the slopes of Mount Kenya.

Munderendu is suitable for pick and hammer shafts. Weight 50-52lb. per cub ft

Muthiga or Muziga, occurs in the cedar forests and grows to a height of 80-90 ft., diameter 18-24 inches It is heavy, not very hard, scented, pale-yellow, heartwood green when cut but turns brown Weight 53-55 lb. per cub. foot. Suitable for furniture, etc.

Mountain forests. — These forests far exceed in area the other forests. Situated on Mt. Kenya and Mt. Elgon, the Aberdare Mountains and the slopes of the escarpments, they are divided into two distinct classes, viz., those in which cedar and those in which camphor are present, as these trees are never associated together.

Cedar Forests — The cedars (*Juniperus procera*) are the most important in Kenya ; they contain 70 % of the only two coniferous trees of the country, cedar and podo. The chief species composing the forests are :—

Cedar (*Juniperus procera*), height 90-100 ft., diameter 36-48 inches. Timber light, soft, reddish-brown, scented, works easily, polishes, rather brittle, liable to crack, seasons well, does not warp. Weight, 38-42 lb. per cub. ft. Is not attacked by termites. Suitable for pencil-making, but is harder than American cedar. Used locally for cabinet-making, floor boards, shingles etc. It is estimated that there are at least 50 000 acres within 20 miles of the railway, yielding 500 cub. ft. per acre.

Yellow-Wood (*Podocarpus gracilior*). Light, soft, yellow, fine grain, few knots, does not split, not durable, requires careful seasonig, liable

to warp. Weight, 33-35 lb. per cub. ft. Used locally for building construction. Obtainable in lengths up to 30 ft., squaring 18-24 in.

Musharagi (*Olea hochstetteri*), similar to black iron-wood, grows to 70-80 ft., diameter 24-30 in. Timber hard, heavy, straight-grained, olive colour, liable to crack and warp, not easy to season, saws, planes and polishes well. Weight, 50-60 lb. per cub. ft. Used for heavy construction work, wagons, spokes, furniture. Not satisfactoy for railway sleepers.

Mugaita (*Rapanea rhododendroides*), supplies a light-coloured wood, handsome marking, suitable for plywood and panelling. Weight, 42-44 lb. per cub. ft.

Camphor Forests. — Occur in areas where the rainfall is not less than 55-60 in., at elevations of from 7000-9000 ft.

The chief species composing these forests are:

Muzaiti (*Ocotea usambarensis*). The Kenya camphor tree resembles the real camphor tree of China and Japan, but smells less strongly of camphor. Attains a height of 120 ft., with a girth of 30 ft. Very durable, light, soft, easy to work, rich-brown, tough, polished well, splits well, but troisted grain is common, liable to warp. Can be supplied in baulks up to 30 ft., squaring 20-25 in. Weight, 34-36 lb. per cub. ft.; resists attacks of termites. Used in railway carriage construction, cabinet work, etc. Suitable for railway sleepers, but probably too valuable for that purpose.

Mueri (*Pygeom africanum*), Red Stinkwood, belongs to the same genus as muzaiti, attains a height of 80-90 ft., diameter 30-36 in. Supplies a heavy, hard, dense, dark-red timber, difficult to season, durable, not easy to work, will not take nails without boring, does not split. Weight 47-49 lb. per cub. ft. Obtainable in lengths up to 20 ft., squaring 20-24 in. Used for railway trucks, wagon building; suitable for sleepers.

Sleeper Supplies. — The forests of East Africa are disappointing as sources of supplies for railway sleepers because of the cost of felling and extraction and transportation to the coast, distant about 400 to 500 miles. These forests are chiefly on steep mountain slopes and ravines, which increases the cost of extraction, also, being suitable for cabinet-making etc., tends to enhance the price.

The timbers available in quantity, from which sleepers might be obtainable are:

Yellow-wood (*Podocarpus gracilior* and *P. milanjanus*). Sleepers from this wood have not proved very satisfactory because they dry-rot and break owing to brittleness. Sleepers creosoted by the Rueping process may be considered to have a life of about twelve years.

Muhugu (*Brachylena hutchinsii*) appears to be suitable for sleepers without creosoting, but it will be difficult to procure large quantities free from curvature. Railway transport can hardly be provided to these forests under three years, as the survey for the railway is only now being made; 23 sleepers, 7 ft. × 10 in. × 5 in. are to be sent to Durban for test purposes.

Camphor Wood. This wood is perhaps too valuable for sleepers, but samples are being sent to Durban for testing.

Meuri (Red Stinkwood) is suitable, if sufficient quantity can be obtained.

Mukinduri (*Croton elliottanus*) is found in considerable quantity in the vicinity of Nairobi. The wood is of close texture, but would require creosoting. It is estimated that 1 000 000 sleepers could be obtained; this wood is being tested as to its suitability for sleepers.

Uganda Protectorate.

The geographical position of Uganda prevents it from becoming an important exporting country; the natural outlet would be via the Sudan and Egypt, but until the Nile route has been improved this direction is not possible.

The Minzira Forest, about 25 000 acres in extent, is situated on the Uganda-Tanganyika boundary, ten miles from Lake Victoria, on the Kagera River, a swift, deep river now being used for rafting logs to the sawmills.

The chief trees of commercial value are:—

Yellow-wood (*Podocarpus gracilior*), of which it is estimated that 5 000 000 cub. ft. could be procured.

Nkoba (*Baikeæ eminii*), height up to 90 ft., coarse-grained, pinkish. Weight 41-43 lb. per cub. ft. If cut and left in the forest is quickly attacked by boring beetles. It is estimated that 1 000 000 sleepers could be procured. Tests for suitability will be made at Durban.

Mvule (*Chlorophora excelsa*). East African teak, grows to a height of 70-80 ft., girth, 8-18 ft. The wood is coarse-grained, yellowish. Weight 45-46 lb. Used for doors, panelling and furniture. Suitable for sleepers, but probably too valuable. It is estimated that 1 000 000 sleepers could be obtained.

Taganyika Protectorate.

Very large forest areas are found on the southern slopes of Mount Kilimanjaro, within reach of the railway line to Tanga, or via the Voi junction to Mombasa. The chief timbers are:— *Podocarpus*, Mvule, Marsuhma (botanical name unknown), and Msau (bot. name unknown).

Marouhma is suitable for furniture, weight 53 lb. per cub. ft, but is too valuable for sleepers.

Msau, locally known as mahogany is suitable for furniture making.

Samples of many of the above timbers have been sent to the Department of Mines and Industries at Pretoria. W. S. G.

109. **The Yield, Types and Distribution of Sal Forests in the United Provinces, India.**

Smythies, E. A. (Conservator of Forests) and Howard, S. H. (Imperial Silviculturist Dehra Dun). *Indian Forest Records*, Vol. X, Part III, pp. 27-45. Delhi, 1923.

In this publication the authors give a very full account of the Sa Forests in the United Provinces, treating the subject under the follow-

ing heads: Introduction; distribution of Sal forests; methods used in preparing the Yield Table; notes on Yield Table, classification of Sal forests by types; Yield Table with curves. W. S. G.

110. **Extraction of Broad Gauge Sleepers from Nepal.**

COLLIER, J. V. (Deputy Conservator of Forests). Notes on the Work of *Indian Forest Records*, Vol. IX. No. 9, pp. 349-354. figs 13 plate 10 Delhi, 1923.

In 1918 the Government of Nepal offered as a War gift to the British Government 200 000 broad gange sleepers free of royalty, from the Napal sal (*Shorea robusta*) forests of Raman in the valley of the Sarda river, on condition that the extraction of the sleepers should be carried out by British agency. The author was entrusted with the charge of this work, of which this note is a detailed description. The report is illustrated with photographs and plates, and gives particulars of expenditure.

W. S. G.

111. **Summary of Results, of Treated and Untreated Experimental Sleepers laid in the Various Railway Systems of India.**

PEARSON, R. S. (Forest Economist, Forest Research Institute, Dehra Dun, U. P.) *Forest Bulletin*, No. 53, 28 pp. Dehli, 1923.

Results of experiments made for the purpose of testing the durability of certain Indian woods with a view to their use as sleepers on the Indian railways. R. D.

112. **" Mâquis " of " Yana " (*Conocarpus erectus*) in Cuba.**

CORRAL, J. I. Rodales de Yana (*Conocarpus erectus*). *Agricultura y Zootecnia*, Vol. II, No. XI, pp. 360-370, tables 3. Havannah, 1923.

The " Yana " which forms great stands in the vicinity of the Cuban coasts, is a source of excellent charcoal. The author suggests that this tree should be used for afforestation as it thrives in the island. He recalls the general rules to be followed in afforestation, and express his approval of some recent legislative enactments passed for the protection of *Conocarpus erecta* and forbidding the trunk being cut below 90 cm. from the ground. J. P. C.

113. **Production and Export of Brazilian Timber.**

DE ALENCAR, P. A exportação de madeiras. *Brasil-Forte-Carvão*, Year XIV, Vol. XXV, No. 316, pp. 468-469. Rio de Janeiro, 1923.

Dr. Desderio de CAMPOS, Commercial Attaché of Brazil in Italy, suggested to the Minister of Agriculture that a Commission of Experts presided over by the Director of the Intelligence Department of the Agricultural Ministry should be appointed for the purpose of making enquiries with a

view to increasing the exportation of Brazilian timber, a product still little known abroad.

The Commission has recently drawn up a report embodying the measures necessary for the expansion of the trade in Brazilian timber which certainly has a great future. These measures include: 1) improved means of transport (road-making (I) and harbour-works ; building sailing-vessels for the exclusive transport of timber) : 2) low transport tariffs ; 3) supplying the capital required for scientific clearing and re-planting ; 4) building storehouses and warehouses and the granting of credit on the deposit certificate (advancing up to 70 % of the value of the goods stored) ; the warrants system has already been organised in Brazil, but at present great difficulty is experienced in applying it to deposits of timber owing to the bulky character of the product ; 5) care of the forests and re-afforestation ; 6) standardisation and classification ; 7) abatement within reasonable limits of the export duty on timber.

The exportation of timber from Brazil is rapidly increasing: in 1920, 125 394 tons were exported, in 1921, 100 499, and in 1922, 130 956, the value being respectively 20 500 000, 17 977 000 and 22 117 000 *milreis* (1 *milreis* = 2 *shilling* and 2 *pence* at par). F. D.

114. *Musanga Smithii* on the West Coast of Africa.

CHALOT, C. Le Parasolier, ou " Combo-Combo, " *Musanga Smithii* R. Br. de la Côte occidentale d'Afrique *L'Agronomie Coloniale*, Year 9, No. 71, pp. 129-135. Paris, 1923.

A description of *Musanga Smithii* R. Br., the most charcteristic tree of the West Coast of Africa. The author gives an account of its habit and the possible industrial uses to which it might be put. R. D.

LIVE STOCK AND BREEDING.

Hygiene.

115. Yadil on the Farm.

The Bristol Times and Mirror, January 26, 1924.

The new antiseptic " Yadil " is a colourless liquid made from the essential oil of garlic, which although equal to carbolic acid in germicidal strength is claimed by the discoverer to be harmless to cell-tissue.

(1) Transport improvements have been the subject of numerous studies in Brazil. See : *Sociedade Fluminense de Agricultura e Industrias ruraes. Memoria Expositiva e justificativa do Projecto de Lei de Organisacão Technico-Administrativa do Serviço de Viacão Municipal no Estado de Rio de Janeiro formulado pelo Dr.* Enrico TEIXEIRA LEITE *e apresentada ao II Congresso Nacional Estradas de Rodagem em novembro de* 1922, Rio de Janeiro, Siburu Barruti e Cia, 1923 (*Ed.*)

It has been tested in veterinary practice and has been proved to be beneficial in the cure of many diseases of stock and poultry, and is also a powerful preventive of disease. The antiseptic can be taken internally, or used externally, and is very wide in its applications. W. S. G.

116. **A Note on *Argasidae* found in the Punjab.**

Cross, H. E. and Patel, P. G. *Department of Agriculture, Punjab, Veterinary Bulletin*, No. 9, pp. 13, plates 5. Lahore, 1922.

A contribution to the bionomics of the *Ixodidiae* (ticks) of India. The two genera, *Arges* and *Ornithodorus* (fam. *Argasidae*) are described and also the various species found in the region : *A. persicus* (transmission agent of avarian spirochaetosis), *A. vespertilionis*, *A. savignyi*, *A. lahorensis*, and finally, a species recently designated as *O. crossii* by Prof. Brompt which is regarded as one of the agents of the transmission of surra.

G. T.

117. **Cutaneous Vaccination against Anthrax in Horses.**

Brocq-Rousseau and Urbain. Cuti-Vaccination et Cuti-Immunité anticharbonneuse chez le cheval. *Recueil de Médecine vétérinaire*, Vol. XCIV, No. 24, pp. 482-487. Paris, 1923.

The author have found as a result of experiments that cutaneous vaccination against anthrax is possible in the case of the horse.

The immunity acquired is complete and lasting. No antibodies take part in the process. P. D.

118. **Experiments on the Disinfection in Mammals, especially in Relation to Dourine in Horses.**

Iwanow, E. (Moscow). (*Parasitology*, Vol. XV, 1923, pp. 122-127). *Bulletin de l'Institut Pasteur, Microbiologie*, Vol. XXI, No. 23, p. 927. Paris, 1923.

The author set himself the task of removing the virulence of the spermatozoa of stallions affected with coition disease without destroying the fertilising property of the male cells. He advises that the vagina should be washed before, and the penis after, coition with a 1 : 10 000 dilution of Salvarsan, or Neo-Salvarsan, in physiological water. It is advised also that his method of artificial fertilisation (1) be adopted and the addition of the above-named solution to the seminal fluid.. The penis may be smeared with an arseno-benzine ointment (1 : 10 000). G. Tg.

119. **Pyoktanin coeruleum for Treating Summer Sores in Horses.**

Piccolini, S. La pioctanina violetta nel trattamento delle piaghe estive degli equini. *La Clinica Veterinaria*, Year XLVI, Nos. 10-11, pp. 711-712. Milan, 1923.

Good results have been obtained with an alcoholic solution of pyoktanin coeruleum (made by the firm of Merck in Darmstadt) in the treatment of granular dermitis in horses. G. Tg.

(1) See *R.* 1923, No. 416. (*Ed.*)

120. The Ranunculus and Haemoglobinuria in Calves.

GRIMALDI, E. and PAGLIARINI, T. (Veterinari comunali, Ufficio d'igiene del Comune di Modena). L'emoglobinuria dei vitelli nel Modenese. *La Clinica Veterinaria*, Year XLVI, Nos. 10-11, pp. 604-615. Milan, 1923.

In the Provinces of Modena and Reggio, where the cheese-making industry is much developed, the farmers are induced by high profits to sell their milk to the cheese factories where it fetches an excellent price. This practice is very detrimental to calf-rearing, for the young animals are weaned too early (25-30-40 days after birth), and fed on a diet of fresh and dry fodder, meal and cakes which is quite unsuitable to the still weak digestive system of sucking-calves.

The authors report cases of haemoglobinuria in the Province of Modena, and are of opinion that this diet results in the general physiological deterioration of the young organism partly by changing the chemical processes taking place in the stomach and intestines, and more especially by alteration of the quantitative and qualitative splitting up of the fats in the intestine. This causes the consequent formation of lipoids with a strong haemolitic action, or brings about the liberation of cholesterin in a free state and not in the ethereal form (oleate, palmitate). In both the latter cases, haemoglobinuria is caused that would seem, according to the authors, to be accelerated by the large quantity of ranunculus plants eaten by the calves. The most common species of Ranunculus (*R. bulbosus*, *R. velutinus*, *R. sceleratus*, *R. arvensis*, *R. Ficaria*, etc.) are found in spring throughout the wide stretches of grassland in Emilia covering the ground with their luxuriant growth.

The sapotoxin present in the ranunculus does not seem to have the property possessed by some saponins of combining with the traces of cholesterin present in the blood serum and thus becoming innocuous. It appears to retain unaltered its haemolytic power, that is to say, its property of entering into combination with the lecithin of the erythrocytes.

G. Tg.

121. The Bacterial Content of Cow Faeces.

ALLEN, P. W. (Bacteriological Department, Washington Experiment Station, Pulman, Washington). *Journal of Dairy Science*, Vol. VI, No. 5, pp. 479-482. Baltimore, 1923.

In estimating the contamination of milk, it has hitherto been reckoned that the average number of bacteria present per gm. of cow faeces is 5 millions, Dr. PRUCHA, however, stated at the Nineteenth Annual Meeting of the Society of American Bacteriologists that the above faeces when in a dry state may well contain one billion bacteria per gm. The writer consequently wished to verify these data and to obtain further evidence on the subject. On making suitable cultures of desiccated cow faeces, he found the number of bacteria present reached 9 million per gm. and in one case, it exceeded 16 million per gm. Had he employed synthetic nutrient media and a hydrogen-ion concentration of 6.8 to 7.3 he could have obtained higher figures.

[120-121]

It is therefore necessary to modify the ideas at present held as regards the bacterial contamination of the milk on the market.

G. Tg.

122. Camel Trypano-somiasis in Turkestan.

YAKIMOFF, W. L. (1) A propos du *Trypanoma nimae*. *Kohl-yakimoff*. (2) A propos de la trypanosomiase des chameaux russes (*Bulletin de la Société de Pathologie exotique*, vol. XVI, pp. 249 and 314, 1923). *Bulletin de l'Institut Pasteur, Microbiologie*, Vol. XXI, No. 23, pp. 925-926. Paris, 1923.

Two notes dealing with camel trypano-somiasis in Turkestan, and especially in Russian Turkestan, the Ural region and the Governments of Astrakan and Saratov. The most noticeable symptom of the disease is hypertrophy of the lymphatic glands, particularly of the deep cervical lymphatic glands.

G. Tg.

123. Surra Trasmission Experiments.

CROSS H. E. (Camel Specialist) and PATEL P. G. *Department of Agriculture, Veterinary Bulletin*, No. 5, 19 pp., tables 7. Lahore, 1923.

An account of experiments carried out in the Punjab on dogs, rabbits and white mice with the object of determining whether surra is transmitted by the agency of *Tabanus albimedius* (very common in the region), *Tabanus bicellosus*, *T. virgo*, *T. persis*, a tabanus which has not yet been identified, and of *Ctenocephalus felix*. The authors give a detailed description of the life-history of all these insects. The numerous experimental data are given a table which shows that transmission could hardly ever be produced except by allowing *Tabanus* to feed on camels suffering from trypanosomasis. Negative results, in all but two cases, were obtained when the parasites were fed on infected dogs, rabbits and buffaloes.

G. Tg.

124. The Agent of Contagious Agalaxy and its Cultivation.

BRIDRÉ, J. (Chef de Laboratoire à l'Institut Pasteur de Paris) and DONATIEN, A. (Chef de Laboratoire à l'Institut Pasteur d'Algérie). La microbe de l'Agalaxie contagieuse et sa culture *in vitro*. *Recueil de Médecine Vétérinaire*, Vol. XCIX, No. 22, pp. 441-444. Paris, 1923.

Bacteriological and histological research had failed to discover the specific agent of contagious sheep agalaxy, all that was known being that it could pass through certain filters (BERKEFELD, SILBERSMITH filters). The authors, however, appear to have identified the micro-organism as an attenuated body 5 microns long which occurs under different forms but retains its given characters in cultures. It is interesting to note that in some of its characters it resembles the agent of contagious peripneumonia which was the first filtrable virus ever cultivated (NOCARD, ROUX, BORREL, SALIMBENI and DUJARDIN-BEAUMETZ).

G. Tg.

125. Diseases, Ailments and Abnormal Conditions of Swine.

WHITE, T. P. (Assistant Chief, Division of Hog-Cholera Control, Bureau of Animal Industry), *U. S. Department of Agriculture, Farmers' Bulletin*, No. 1244, 26 pp. figs. 8. Washington, D. C. 1923.

A popular description of the symptoms of the various affections that may easily be mistaken for hog-cholera during an epizootic outbreak of that disease. The author also treats of other pathological conditions, which at all events in their incipient stages, can well be controlled by the pig-breeder himself. Another object of this publication is to prevent, by means of the diffusion of the most elementary rules of hygiene and prophylaxis, the very frequent losses entailed in the transport of large numbers of swine from the breeding Stations to the abattoirs, or the butchers. G. Tg.

126.. Vitamines and Their Relation to Poultry Diseases.

BEAUDETTE F. B. *The National Poultry Journal*, Vol. IV, No. 188, pp. 502-503. London, 1924.

The author studies the effects produced on the health of poultry by the lack of the different vitamines. A deficiency in vitamine *A* induces xerophthalmia, slow growth, and symptoms of languor together with loss of flesh frequently accompanied by diarrhoea. The comb turns pale, or bluish ; in the more advanced stage of the disease, the eye is surrounded by a whitish, easily detached deposit with no special odour. Postmortem examination reveals a contracted oesophagus on the upper, or lower, portion of which appear small whitish bodies of the size of a millet seeds. The kidneys, ureters and heart are filled with a white deposit of urates ; the liver looks as if it were powdered with talc. All that is needed to cure these symptoms is a diet rich in vitamine *A* ; their occurrence can be prevented by giving the poultry green food in summer and germinated oats during the winter. The absence of vitamine *B*, causes polyneuritis or beriberi, especially in chicks ; the head is thrown backwards, and the legs become paralysed. The sick bird is always very thin. Postmortem examination shows the muscles of the chest to have become almost entirely atrophied ; the internal organs, especially the muscles, assume a dark colour. Power of locomotion can be restored to the bird after a few hours by giving it a solution of yeast ; and within the next 24 hours, all the symptoms, with the exception of the emaciation, will have disappeared.

A deficiency in vitamine *C* gives rise to scurvy but without producing any of the characteristic symptoms, or anatomical lesions, usually accompanying that disease. Where vitamine *D* is absent, rachitism appears, especially in chickens, which though they appear strong, and vigorous, are unsteady on their legs. This disease can be prevented by adding 5 % of cod-liver oil to the ration. It should be remarked that chicks must have air and exercise. The experiment seems to prove that if hens are fed a

ration poor in vitamines, the number of fertilised eggs failing to hatch out is larger than when the diet of the birds has been normal and complete.
P. D.

127. **Entero-Hepatitis in Young Turkeys.**

PANISSET, L. (Professeur à l'École d'Alfort). L'Entéro-hépatite des dindonneaux. *La Vie Agricole et Rurale*, Vol. XIII, Year 12, No. 49, pp. 40-401. Paris, 1923.

Entero-hepatitis is a contagious disease that often proves fatal to turkeys ; it chiefly attacks selected breeding-stock and young birds. The author describes the external symptoms and also the anatomic lesions revealed by post-mortem examination. Parasitic infection, moulting, the mating season, and the presence of intestinal worms are all favourable to an outbreak of this disease of which the agent is at present unknown. Contagion is conveyed in a very large number of ways, and can only be prevented by scrupulous cleanliness, a sound and varied diet, and by protecting the turkeys from external parasites. If a turkey-farm is attacked, all the birds must be killed, and the entire premises carefully disinfected before breeding can again be begun. P. D.

Breeding.

128. **Studies of the Chromosomes X and Y and of their Crossing-Over.**

I. — TATUA AIDA (Higher Technical School, Kyoto, Japan). On the Inheritance of Colour in a Fresh-Water Fish, *Aplocheilus latipes* Tammick and Schlegel, with Special Reference to Sex-Linked Inheritance. *Genetics*, Vol. VI, No. 6, p. 554-573, figs. 6, bibliography. Baltimore, 1921.

II. — WINGE, O. A Peculiar Mode of Inheritance and Its Cytological Explanation. *Comptes rendus des Travaux du Laboratoire Carlsberg*, Vol. 14, No. 17, pp. 1-9, figs. 10. Copenhagen, 1922.

III. — IBID. One-Sided Masculine and Sex-Linked Inheritance in *Lebistes reticulatus*. *Ibid.*, Vol. 14, No. 18, pp. 1-20, plates 2. bibliography. Copenhagen 1922.

IV. — IBID. Crossing-Over between the X and the Y Chromosomes in *Lebistes*. *Ibid.*, Vol. 14, No. 20, pp. 1-19, fig. 1, bibliography. Copenhagen, 1923.

I. — The author studied the hereditary transmission of 5 characters in the fresh-water fish, *Aplocheilus latipes*, Temmick and Schlegel. He believes, as a result of his researches, that the factor for one of these characters, which is dominant as regards the others, must be present in the chromosomes X and Y. He also obtained phenotypes that can only be explained by crossing-over, as is shown by the diagrams I and II.

II — The author made a cytological study of the fish *Lebistes reticulatus* and found 46 chromosomes in the somatic cells, and 23 chromosomes in the gametes of both sexes, though he was unable to distinguish the sexual cells of the autosomes. Basing his opinion on the observations of

DIAGRAM I.

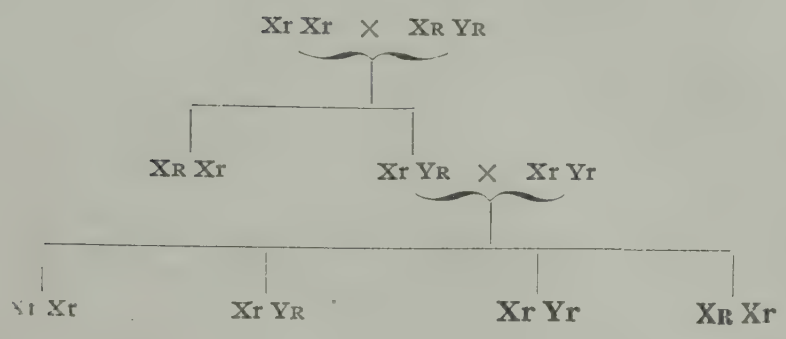
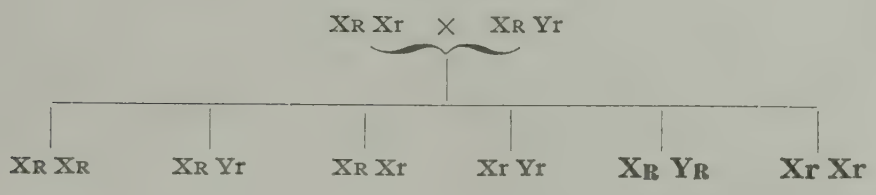


DIAGRAM II.



I and II. — Crossing over in *Aplocheilus latipes*.

J. SCHMIDT (1) he supposes that the males have sexual chromosomes of the X Y type and the females, sexual chromosomes of the X X type, the unilateral transmission of certain characters from father to son being due to factors present in the chromosome Y.

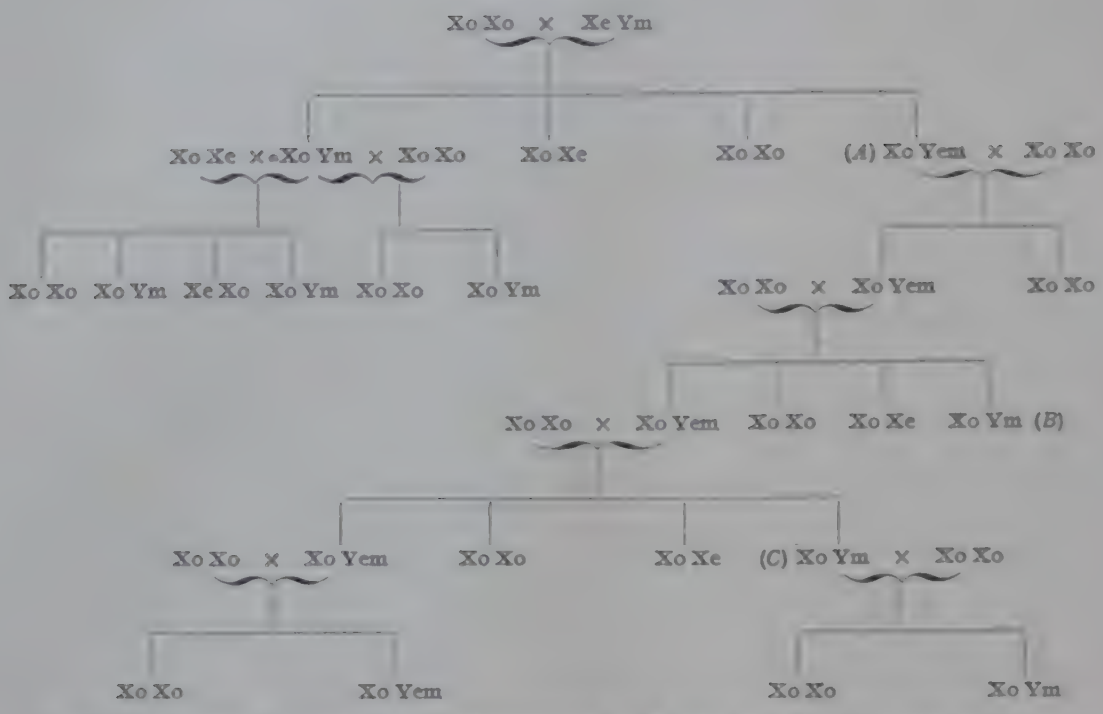
III. — A study of the transmission of secondary sexual characters in *Lebistes reticulatus*. The secondary sexual characters of the male are also transmitted according to the laws of sex-linkage, which proves the presence of their factors in the chromosome X. This chromosome would appear to be homologous with the chromosome Y which confirms the hypothesis brought forward in the preceding study. The author describes 4 kinds of chromosome Y that all contain the factors for certain colours and 2 kinds of chromosome X in one of which the colour factor is lacking. When the latter chromosome comes into play, we have one-sided masculine transmission of the secondary sexual characters, whereas when the chromosome X contains all the factors, the transmission of these characters is a combination of one-sided transmission and sex-.linked transmission (2). The author also draws attention to a cross where there seems to be a crossing-over between chromosome X and chromosome Y.

IV. — In order to ascertain whether there was any crossing-over between chromosomes X and Y in *Lebistes*, the author carried out some experiments with a variety of this fish in which the male ought to have factor *m* in chromosome Y, and a factor *e* in chromosome X. He obtained

(1) The Genetic Behaviour of a Secondary Sexual Character. *Comptes rendus des travaux du Laboratoire de Carlsberg*, Vol. XIV, No. 8, 1920. (*Ed.*)

(2) The author speaks of one-sided trasmission when the factor is situated in chromosome Y, and of sex-linked trasmission when the factor is in chromosome X.

DIAGRAM III.


Xo Xo × Xe Ym
Xo Xe × Xo Ym × Xo Xo
Xo Xe
Xo Xo
(A) Xo Yem × Xo Xo
Xo Xo Xo Ym Xe Xo Xo Ym Xo Xo Xo Ym
Xo Xo × Xo Yem
Xo Xo
Xo Xo × Xo Yem Xo Xo Xo Xe Xo Ym (B)
Xo Xo × Xo Yem
Xo Xo
Xo Xe (C) Xo Ym × Xo Xo
Xo Xo
Xo Yem
Xo Xo
Xo Ym

III. — Crossing over, between Chromosomes X and Y in *Lebistes reticulatus*.

several individuals (amongst others, A-E and C in diagram II) of which the genotypic formula could only be the result of the crossing-over of the chromosomes X and Y of the male parent. From the results of these experiments, he also concluded that the chromosomes X and Y respectively contain a recessive female sexual factor and a dominant male sexual factor ; he further believes these two allelomorphic factors to be similar to other genes, seeing that they are bi-localised in their chromosome and more or less, linked with other factors.

Breeding.

129. Inheritance of Coat Colour in Horses (1).

MOLHANT, A. (Professeur à l'Université de Louvain). L'hérédité de la couleur de la robe chez le cheval. *Journal de la Société Nationale des Agriculteurs de Belgique*, Year 5, Nos. 47-48, pp. 369-370, 378-379. Brussels, 1923.

The studies of STURTENANT, WALTHER, CRAMPE, HURST, BUNSOW, and especially of WENTWORTH, have shown that a series of genetic factors are involved in the determination of the different colours of the coat in horses. Some of these factors serve as the basis of the pigmentation, others are epispatic, viz., they inhibit, or weaken, the action of the first set of factors, while another set seem to add some accessory to the coat colour altering its shade, but leaving unchanged the effect of the basal factors. The author, after citing actual instances of all these genetic

(1) See *R.* 1921, No. 1140 ; *R.* 1922, No. 283. (*Ed.*)

factors, points out that the knowledge of their existence would throw light upon the parentage of a horse in many cases where this is a matter of uncertainity, and further, that it proves every individual's power of transmission to be limited to the characters of its own germ-cells. In any case, no individual transmits coat colour better or worse, than another, therefore the colour of the coat is no sign of individual prepotency and cannot be affected by any ancestor, for it depends solely upon direct transmission from the two parents, in other words, coat colour is immediately dependent upon the parents. Hence, from coat colour no other hereditary characters can be inferred. The colour, or shade, can have been transmitted in its entirety to the offspring without it following that the other hereditary characters of the parents have been transmitted to the same extent. In fact, these laws do not seem to confirm the very commonly held opinion that the progeny of given stallions, or mares, will have a certain coat colour. They are, however, more useful to the breeder, since colour is no evidence of the prepotency of an ancestor having the same characteristic pigmentation. G. Tg

Horses.

130. **Reduction of Cartilage, a Functional Adaptation.**

Mensa A. (Direttore dell'Istituto di Chirurgia Veterinaria della R. Università di Modena). Di un « equus apertus ante » acqusiisto per adattamento funzionale. *Il Nuovo Ercolani,* Year XXVII, No. 21, pp. 293-303, figs. 3; bibliography. Turin, 1923.

Among a drove of horses sent for slaughter from Lubiana to Trieste, the author found one animal that presented an interesting case from the point of view of functional adaptation.

This animal was distinguished by an extreme reduction of the dorsal cartilage of the scapula.

It is perhaps worth while drawing the attention of stock-breeders and anatomists to this peculiarity, for the author states that he has himself met with a similar deficiency in cartilage development in Dalmatian and Yugo-Slavian horses of the same type as the animal in question. The scapular cartilage in these cases was reduced to the extent of forming a short, narrow appendix. G. Tg.

131. **Cost of Upkeep of Six-Horse-Team Unit in New Zealand.**

Fawcett, E. J. (Asst. Instructor in Agriculture, Christchurch). *New Zealand Journal of Agriculture,* pp. 355-364, Tables 8, Vol. XXVII, No. 6. Wellington, 1923.

In undertaking this work the author's idea was, largely, to suggest to farmers the great importance to themselves of an exhaustive inquiry into the costs of raising farm produce. In working the investigation the following points were kept in view: 1) the cost of maintaining a six-horse team for one year; 2) the cost of cultural operations per acre, cal-

culated at 150, 175, 200, 225, 250 and 275 working days per annum. Twenty-seven farms were selected and visited personally to obtain the required information, and from the data obtained it was shown that the average cost of upkeep of six horses and equipment is £548-5-8 per annum, or £592-9-8 for seven horses and equipment.

The power unit is the most expensive item on the farm and bad management of the team alone will cause a debit balance, as every day the team is idle the cost to the farmer is nearly £2, for which there is no return.

W. S. G.

Cattle.

132. **Determination of the Surface Area of Cattle and Swine.**

HOGAN, A. G. and SKOUBY, C. J. (Laboratory of Animal Husbandry, College of Agriculture, University of Missouri). *Journal of Agricultural Research*, Vol. XXV, No. 10, pp. 419-240, 2 plates, bibliography. Washington, 1923.

The authors first describe the work that has already been done in this direction and give the chief formulae still in use. They then pass on to treat of the experimental method they have themselves adopted for estimating the body area of living animals. By means of tough paper of known weight per sq. foot they obtained an actual mould of half the body, from which could be estimated the body area of the animal by a simple calculation. In order to test the accuracy of the results thus obtained, the authors made measurements by triangulation on the hides of animals that had been slaughtered. The difference proved less than 0.5 %. In calculating the formula, the authors use the measurement "length of body," viz., the distance between the top of the withers and the point of the ischium, in cattle, and the root of the tail in swine. They give the exact anatomical position of the following points: "height of withers" between the 2nd and 3nd thoracic vertebrae in cattle, and between the 1st and 2nd in swine; "point of the ischium" is the ischial tuberosity; the "root of the tail" is the point of its attachment to the body. The weight of the animal should be determined when the measurements are taken and at a time when the subject of the experiment has not recently eaten, or drunk. The experiments were made on cattle of ordinary and selected races respectively; the age of the animals varied from 6 weeks to 8 years, and their weight ranged from 55 to 842 kg., the body length varying from 61 to 172 cm. Their condition varied from quite thin to a fine finish. The swine were pure-bred Poland-Chinas, Duroc-Jerseys and Yorkshires; age ranged from 3 weeks to 3 years, and live-weight from 2.5 to 178.1 kg. The body length was from 24 to 132 cm. Their condition varied from quite thin to very fat. The authors give tables showing the live-weight, the length of body, and the body surface. They then calculate the formula: $S = W\ 4 \times L\ 6 \times K$ where S = body surface, W = live-weight, L = length of body in cm., and K is a constant, which is 217.02 in the case of the cattle and 175 in that of the swine. In the following tables, the authors compare the respective results obtained by measurement and by

calculation both according to their own formula and to other formulae that are also in use. A careful study of the data shows the authors' formula to be applicable in all cases and for all animals, since the maximum error always remained below 5.5 %. P. D.

133. The Vosges Cattle Breed (1).

Bojoly A. (Veterinaire Secretaire général de l'Union agricole de l'arrondissement de Saint-Dié). La race bovine vosgienne. *Revue de Zootecnie*, Year 2, No. 11 pp. 357-367. 1 sketch, figs 2. Paris, 1913.

In October 1922, the Agricultural Director of Alsace-Lorraine started a Herd-book for Vosges cattle. The animals of this breed are small, but thrifty and hardy, being thus well suited to a country with limited agricultural resources. All conversilinear, or concurvilinear, hybrids due to the penetration of the Friburg and Dutch breeds, are excluded from the Herd-book. With a view to replenishing the herds of cattle in the region which suffered severely from loss of its live-stock during the War, a large number of the most different breeds (Friesian, Dutch, Swiss, Norman, Breton, etc.) were introduced, so that at the present moment, there are in the Vosges, many hybrids resulting from haphazard crossing, and the pure-bred individuals of the native breed have consequently been still further reduced. During the last fifty years, the native cattle have been driven from the Vosges plateau by the numerous infiltrations not only of the Dutch type, but also of the Montbeliard breed so that in order to find the pure-bred aboriginal stock, it is necessary to search the chain of the Vosges and ascend the valleys of the Moselle, Meurthe, Poutroye, etc. In the Cantons of Gerardmer and of Corcieux, nothing but heterogeneous hybrids exist, and if in the upper valleys of the Sarre and of the Zorn, an occasional pure-bred animal may be discovered, it is lost in the mass of cross-bred cattle that increase in numbers as Saverne is approached.

In the Herd-book, the distinctive characters of the Vosges breed for the districts of Thann, Colmar, Guebwiller, Ribeanvillé, Sélestat and Molsheim have been fixed as follows : *skull* : brachycephalic with projecting nape of neck ; *horns* black, or with black tips, and round section. They arise at the sides and then curve upwards, the points being bent back ; *profile* straight, *forehead* straight, face short and flat, muzzle wide ; *height* : bulls and bull-calves, 1.20-1.25 m. ; cows and heifers minimum 1.15-1.20 ; *coat* ebony black, with large white patch on back and white stripe extending from front of chest to groin ; the sides of the neck and of the barrel should be black and also the upper part of the legs ; the legs are often spotted ; the head is white, with spots, the eys are encircled with black, the tail is white ; the *muzzle* is grey or black ; the *udder* often covered with hair, the teats are black ; the hoofs black, or striped with black ; depth of chest usually half the height at withers, width of chest and width of pelvis a third of height at withers. The Vosges breed is a single purpose breed producing milk rich in butter-fat. The animals are

(1) See *R.* July-Sept., 1923, p. 818. (*Ed.*)

thrifty and agile being well suited to granitic or sandy land; they are energetic, resistant and quick workers.

The author gives the following data respecting the milk producing capacity of the Vosges cow: total milk yield of cow of average weight (420-450 kg.) 2100-2200 litres distributed as follows: first month after calving, average of 12 litres daily; later, up to the 7th month inclusive, average of 8 litres daily, during 8th, 9th and 10th months an average of 4 litres. Thus, the average daily yield is 7 litres. Of the total 2160 litres, 160 litres are used for feeding the calf

As a rule, 7-8 litres of this milk are required for making 1 kg. of cheese; therefore about 250 kg. of cheese can be made annually on an average from the milk of a single cow. G. Tg.

134. Horse-Rumped Cattle at the Piedmontese Breeders' Congress (Mondovì, 1923).

134 Communicated by Prof. ETTORE MASCHERONI (Libero docente di zootecnia alla Scuola Superiore di Veterinaria di Torino) through the Delegate of Italy at the International Institute of Agriculture.

The term « horse-rumped » is applied to cattle that possess from their birth a large rounded rump with well-developed muscles, projecting buttocks sometimes separated by a deep groove ending at the point of attachment of the tail as in the case of a filly belonging to a heavy draught breed. This horse-shaped rump does not, however, always develop in a regular and uniform manner, for while in some cattle it is scarcely noticeable, in others, it attains a considerable size. Further in certain animals, this rump is developed in the anterior-posterior direction, but in others, the muscular masses are much developed to match with the ilia, in which case, the front part of the body is much broader than the hind part. Moreover, in the latter individuals the muscular masses are much developed in keeping with the shoulders.

These horse-rumped animals also called double-rumped cattle (*a groppa doppia*), or cattle with horses' haunches (in French *à cul de poulain*, or *mulet*, in German *doppellender*) are to be found in breeds differing from one another considerably in morphological characters such as, for instance, the Charolais, Dutch and the Italian Piedmontese and Demonte breeds. Since this anomalous structure had never been the object of special research, the author has recently systematically studied the Piedmontese and Demonte breeds in which it occurs. Piedmontese cattle with this characteristic are chiefly reared in the Albese and Saluzzese districts.

The horse-rumped individuals of both the above breeds are at once distinguishable from ordinary calves by the following characters: thin soft skin, very well-developed muscles of shoulders, loins, croup, buttocks; chest sunk, abdomen narrow; legs somewhat short; hocks straight; very slender knee-joint and lower hock joints; serious defects of equilibrium; vulva and teats of cows always small.

When slaughtered, the digestive canal, together with the fat of the adipose tissues and of the mesentery, form a small mass, there is little kidney

Piedmontese Calf of 4 months old with horse-rump.
(Live weight 194 kg.; dead weight 136 kg.; yield of veal 70 %).
Owing to the well developed muscles of the rump, haunch, abdomen, ribs and shoulder, the calf fetches a high price.

PLATE X

Characteristic horse-rumps of two Piedmontese calves exhibited at a Cattle Show at Carignano (Turin)

at ; the subcutaneous layer of adipose-cells is thin, the flesh is lighter in colour and of a finer softer texture than that of ordinary cattle, so that it easily disintegrates when rubbed between the fingers, the muscles are much developed and free from intra and intermuscular fat ; bones small.

The net dressing yield of horse-rumped calves is far higher than that of normally shaped animals, the average percentage as shown by numerous estimates made by the author at the Turin abattoir, being 64.55 instead of 55.08. For this reason, and owing to the lighter skin which may vary 10 kg. in calves of the same weight (this is important when hides cost little), and to the hind-quarters weighing sometimes 20-30 kg. more than the quarter these calves are highly valued. The Turin butchers, however, sever the fore from the hind-quarters by a cut passing between the sixth and seventh rib and running in one direction to the corresponding vertebra and in the other to the breast-bone, therefore as the abdominal wall (paunch) and the kidney-piece are removed and weighed together with the fore-quarters, the weight of the latter is brought up to about that of the hind-quarters. The difference in the actual weight of the fore and hind-quarters depends also to some extent upon the fact that the abdominal wall is much thinner and the kidney-piece is almost *nil*. Such cattle are much prized by the butchers who will pay for this type of calf as much as 50-100 lire the quintal more than for an ordinary calf.

Horse-rumped calves are also in great demand because the veal being colourless and tender may easily pass for that of suckling calves, even if the animal is practically adult. Further, owing to the large masses of muscle, boneless meat can easily be obtained while meat from the fore-quarters can well be passed off as veal from the hind-quarters. In these calves, the butchers say all parts are the hind-quarters.

What is the origin of these horse-rumped cattle and to what cause may their conformation be ascribed? So far, little is known for certain in this connection. By some persons, this anomalous structure is regarded as a mechanical pathogical phenomenon (THIERRY) resulting from difficult calving during which the rump muscles of the foetus were unduly compressed and the muscles of the thighs (*sic*) were increased in volume by a hypersecretion of the intramuscular and subcutaneous serum. Others suggest that it is a teratological phenomenon, while certain breeders regard it at all events in the Piedmontese race, as produced by crossing, better feeding, and careful selection.

The author, on the other hand, believes that the peculiarity may be explained in the light of the Mendelian theory and is possibly due to the sudden appearance of hereditary factors. Before, however, the last word can be said in this controversy, further researches are necessary. It is an indisputable fact that once this special form of rump has appeared in a descendant of normaly shaped parents the enormous development of certain masses of muscle is transmitted by heredity.

In Piedmont, the question of horse-rumped cattle has always been the subject of extensive and heated discussion among veterinaries and agriculturists alike.

Is this variety, or sub-race, whichever it may be called, of the Pied-

ment breed to spread in the breeding farms of the province and be awarded prizes at shows, or should it be proscribed and banished from the cattle-sheds? Much can be said in its favour, but no definite conclusions have been reached. Advice and suggestion have been offered, strong opinions for and against it have been expressed, but to what avail? They have led to nothing, and in the absence of the clear definite declaration of a competent authority, there has always been a serious discrepancy in the judgements and opinions expressed. The faults alleged against these cattle are as follows. The conformation of the cows renders calving difficult, and causes losses from difficulties of parturition; for the first few weeks, the calves are difficult to rear owing to their large and often pendant tongues which they cannot apply well to the teat of the dam so as to suck properly, and also because, being affected with rachitism, they stand with difficulty, while they are much subject to intestinal troubles, resulting in a poisoning of the muscles of the shoulders and rump. The bulls have little sexual instinct and the cows are rather sterile and poor milkers. The meat has little flavour.

At the seventh Congress of the Piedmontese Breeders held at Mondovì on September 8, 1923, an attempt was made to decide this question and obtain a clear and decisive statement.

The majority of the members declared themselves to be averse to the breeding of the rumped cattle, although they admitted that the appearance of this special conformation is a matter of satisfaction because of the large gain it insures.

The Congress decided not to banish these animals, but to advise that further studies and researches should be made in order to arrive at a definite conclusion. This decision was based on the fact that the above-mentioned objections were not founded on any irrefutable evidence, and further, that since these cattle have a high market value, a very important stock-breeding problem is at stake. The members thus contented themselves with expressing their opinion that horse-rumped Piedmont cattle should generally be excluded from all shows and that they should only be admitted under exceptional circumstances, and in places where the cattle-breeding industry makes a speciality of such animals, in which case, they should be placed in a separate class always, however, supposing that the character of horse-rump is not too pronounced and out of proportion to the other parts of the body.

135. False Ribs in Cattle; Their Unimportance from the Stock-Breeding Standpoint.

NAVEZ, P. (Professor at the Veterinary College of Cureghem). La fausse côte, ou côte avortée, chez la bête bovine. *Annales de Médecine Vétérinaire*. Year 68, Nos. 8 and 9, pp. 344-358. Ixelle-Brussels, 1923.

The author, after mentioning the great importance attributed at shows to false, or abortive ribs in cattle, and stating that the possession of such anomalous structures disqualifies animals for registration in the Herd-books, passes on to study, with the help of comparative anatomy and embryology, the meaning of these anatomical anomalies, in order to discover

their importance from the stock-breeding standpoint. The "floating rib" may represent the 13th rib that has become abortive in the course of development, or more rarely, is a supernumerary 14th rib articulating with the 14th dorsal vertebra, which is also supernumerary, or it may be a real, or apparent, prolongation of the 1st lumbar vertebra. It is only by examining the skeleton that it is possible to detect the relation between the upper end of the false rib and the vertebrae of the spine and thus determine its anatomical origin. No clue is afforded by the study of the live animal, therefore this anomaly must be regarded as an entirely exozoognostic fact.

In certain countries, at various times, false ribs have been considered to be a defect excluding the animals from use as breeding-stock. The author gives the opinion held on the subject in some parts of Belgium and Switzerland, referring to the former decisions of two Conferences at Woedensteil and Brugg respectively which were against giving prizes to abnormal animals. In Germany, however, false ribs are regarded as of no importance, as may be seen by reference to two well-known works on cattle-breeding (PUSCH, *Die Burteilungslehre des Rindes*, Berlin, 1896, and HANSEN, *Lehrbuch der Rinderzucht*, Berlin, 1922).

The author declares himself to be of the opinion that false ribs are merely a anomaly of growth with no effect on function, and should only be regarded as a defect from the aesthetic point of view. G. Tg.

136. **Relation between the various Economic Factors Affecting Milk Production on Dairy Farm.**

I. — MENDUM, S. W. and KELLER, H., Cost of Milk Production. *New Pages in Farming. Annual Report of the Director, Agricultural Experiment Station, University of Wiconsin, Bulletin* No. 339, pp. 63-65, figs. 1. Madison, 1922.

II. — MCDOWELL, J. C. (Dairy Husbandry, Dairy Division, Bureau of Animal Industry). Relation of Production to Income from Dairy Cows. *United States Department of Agriculture, Bulletin* No. 1069, pp. 20, maps 2, tables 8, graphic charts 6, figs. 3, Washington, 1922.

III. — IBIDEM, Influence of Season of Freshening on Production and Income from Dairy Cows. *United States Department of Agriculture, Bulletin* No 1072, pp. 10, tables 9, figs. 2. Washington, 1922.

IV. — WYLLIE, J., B. Sc., N. D. A., Milk Yields, Costs per Gallon and Financial Results. *The Scottish Journal of Agriculture*, Vol. 5, No. 4, pp. 380-392, tables 5, graphic chart 1. London, 1922.

V. — MISNER, E. G., An Economic Study of Dairying on 149 Farms in Broome County, New York. *Cornell University Agricultural Experiment Station, Bulletin* 409, pp. 272-443, maps 5, tables 143, graphic charts 16, figs. 2. Ithaca, New York, 1922.

VI. — WYLLIE J. The Economics of Winter and Summer Milk Production. *The Journal of Ministry of Agriculture*, Vol. XXIX, No. 10, pp. 894-994. London, 1923.

I. COST OF MILK PRODUCTION. — Diagram I shows the relation existing between the amount of milk produced on the one hand, and the quan-

tity of food consumed on the other. The data are arranged in groups according to their origin and classed according to order of production.

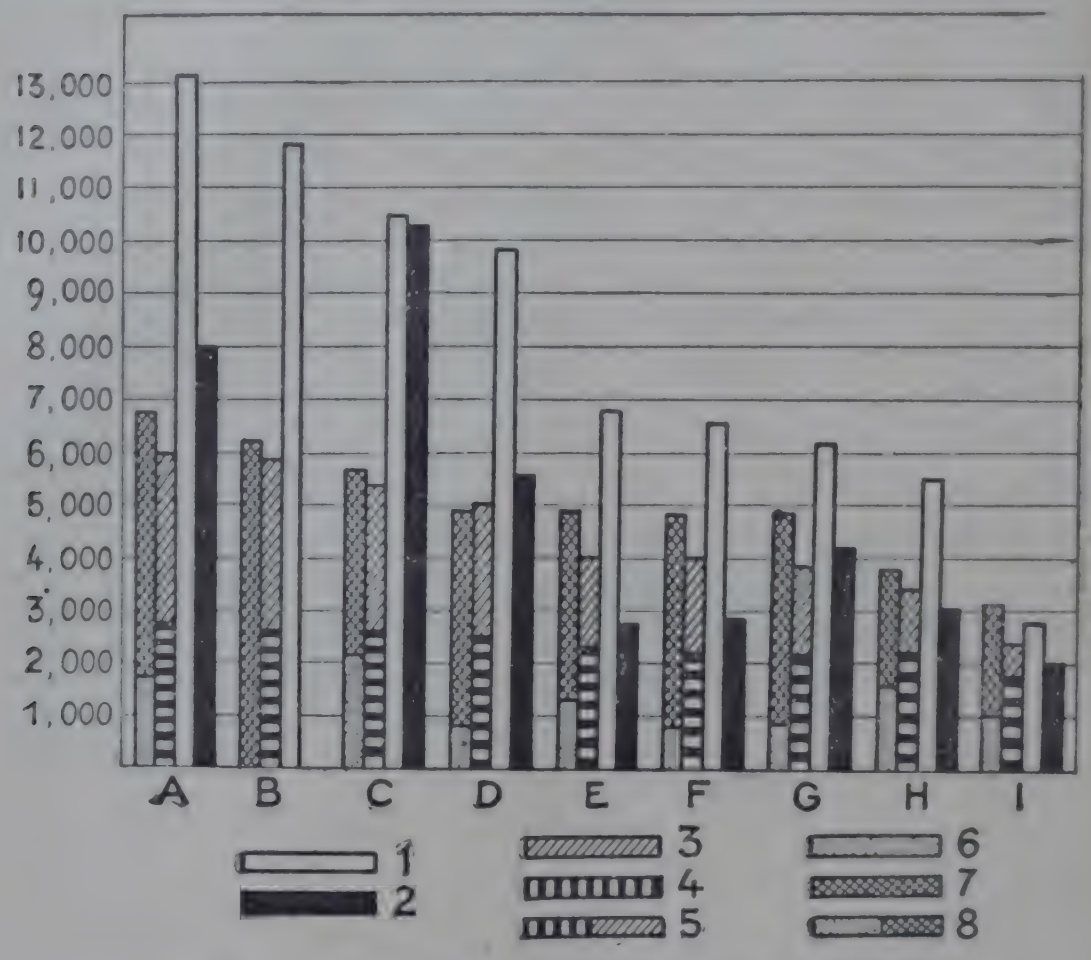


FIG. 1. — Comparison of the relative efficienty of cows.

1 = Rate of production per cow for 1 year in lb.
2 = » » » » » while on pasture (yearly bases in lb.).
3 = Units of feed required for milk produced.
4 = » » » » » maintenance.
5 = Total units of feed required.
6 = Units of feed consumed — furnished by pasture.
7 = » » » » — feeds other than pasture.
8 = Total units of feed consumed.

There is a clear connection between the amount of food required and the quantity of milk produced; the relation between these amounts is almost constant, whatever the milk yield may be; small differences depend on the breed, and are determined to a large extent by the weight of the animal. Figure I shows that it may be said that the animals of each group were given too much food although the excess was not sufficient to affect the unit production cost.

It is difficult to determine the effect of grazing, as a rule, the inte-

rior herds remain longest at grass, but there is some reason for believing that the quality of the herd depends upon the length of the grazing period.

II. Relation of production to income from Dairy Cows. — Mc Dowell set himself the task of estimating the relation between the milk yield of dairy cows and the income of the dairy farm. He used the data supplied by 96 Milk Testing Associations and obtained from 2939 herds, 41 990 cows being submitted to the tests from a period lasting from 1910 to 1920. Each total furnished by one Association referred to one year, but certain Associations, sent data for several years. On an average, each herd was tested once a month. In order to obtain results per herd, or per Association, data were used referring to cows that had been tested for at least 4 months but with this exception, the only data taken into account referred to cows that had been tested for at least 12 months.

The relation between milk production and income. — This is given in a table showing both the cost of feeding and the milk yield of groups 1-9. In group 9, the milk yield is about 8 times as large as in group 1, but the average returns after paying for the food consumed were 61 times higher than in those obtained from group 1. This difference was not due to the price of the milk, for this was less in the case of group 9 than in that of group 1. A graphic chart is given showing the increased returns from the largest milk production for the groups supplying the most data. It required 62 cows of group 1 to obtain the average return from one cow of group 9.

Another table shows the relation existing between milk yield and the cost price of roughage, concentrates, and of the total food consumed.

The average cost of roughage is 1 $^3/_4$ times higher in group 9 than in group 1 ; the cost of the concentrates being 6 times higher and that of the total food 3 times higher.

The relation between the milk production and the returns per unit of expense for food shows that in the case of cows with an average annual milk yield of 5460 kg,, the returns per unit of outlay were about half as high again as those of cows with an annual milk yield of 2730 kg.

The relation between milk production and food expenses per unit of production is seen in fig. 2.

Relation between butter production and income. — This relation shows that each increase in production of 22.75 kg. reckoning from a production of 66.250 op to 182 kg. makes an increased return of 16 dollars ; while above 152 kg, a further increase of 22.75 kg. raises the returns 16 dollars. No doubt there is a limit beyond which it does not pay to increase production, but this limit is seldom reached in feeding cows subjected to milk testing.

These data have only a relative, not an absolute, value. They were worked up in different ways, but always with the same results viz., that the groups of cows with the higher production always gave higher returns, after deducting the food expenses, than groups of poor producers. The graphic charts showing the relative butter production and the re-

turns therefrom had almost the same curves, in spite of the differences in the breed, age, weight and date of calving of the cow, or in the geographical position of the farm.

The cost of roughage only slightly increased in relation to the increased butter-production, but the latter was regularly followed by a rapid rise in the cost of the concentrates fed the cows. The author also found there was a rapid rise in the returns from a higher butter production, this increase in returns being due to a better yield on the part of the cows and to superior feeding.

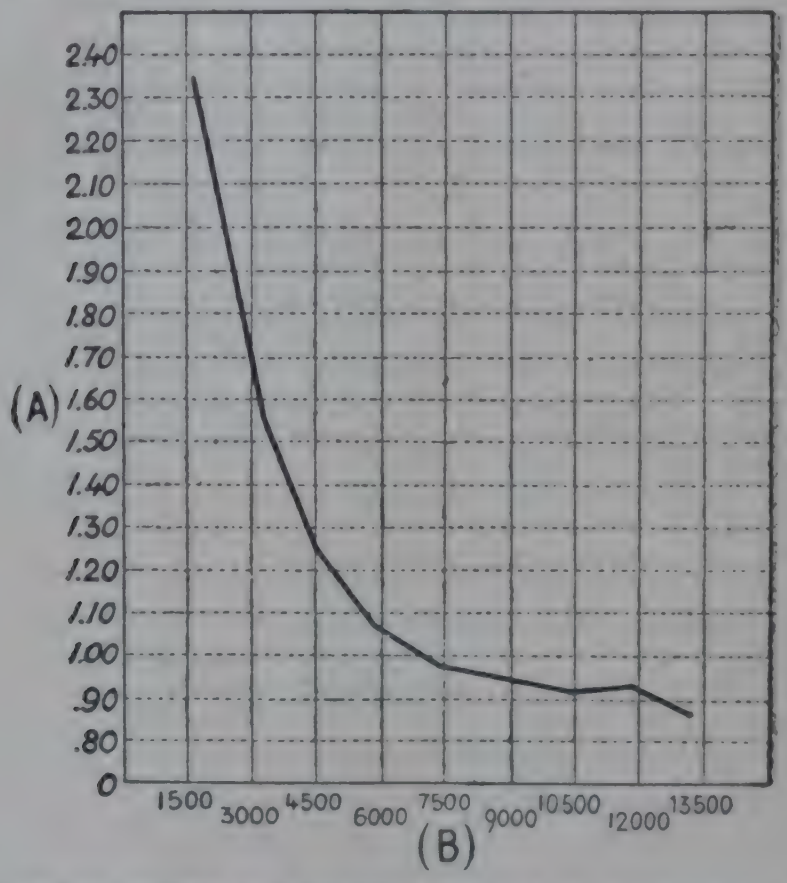


FIG. 2. — Relation between milk production and feed cost per 100 pounds of milk.

A = Feed cost per 100 lb. milk.
B = Pounds of milk per cow.

Another graph gives the relation between butter production and food expenses per unit of production, and it is seen that the latter rapidly decrease as the production rises from 26 kg. to 180 kg. Beyond this amount, the cost of food per production unit falls more slowly.

These same relations were studied on the basis of figures determined not per single cow, but per herd. The increase in returns, after deducting food expenses, was not as pronounced as in the results obtained by the preceding methods, for the data were grouped per herd without any distinction of individual yield. It was, however, always found that

the herds producing more were more profitable (the food cost being deducted), than those with a lower yield.

III. Effect of calving season on production and on income from dairy cows. — An examination of the data worked up by the Milk Testing Associations shows the existence of a definite relation between the calving season and economic factors; further, this relation is seen to vary within certain limits, with the feeding cost, the condition of the pastures and the geographical situation of the farms as regards the markets. For this reason, the following conclusions are based not only on the average of the data furnished by 64 Associations, but also on the averages of each individual Association. The data thus obtained refer to the period 1910-1920, and to 10 870 cows of which the age and calving date were known. The records of each Association were only valid for one year, and in order to prevent mistakes, all data were rejected that did not refer to cows which had not been tested during a period of 12 months. The researches made with a view to ascertaining the importance of the breed and age of the cow showed that these factors do not effect the problem under discussion.

Influence of calving season. — Butter and milk production, food expenses and income (receipts after substracting cost of food) were highest in the case of cows calving in autumn; next came the cows calving in winter. As a rule, cows dropping their calves in the spring produce less milk, and those calving in summer give the least profit. The cost of food, and expecially of concentrates is lowest in spring-calving cows. In spite of this, the latter class of cow does not occupy the first, or even the second, place when classed according to the returns they bring in. If the cost of labour is taken into account, the balance again turns in favour of the autumn and winter calving cows, because labour is very scarce and dear in summer-time in certain districts. The highest average price for butter for the whole year is obtained in the case of cows dropping their calves in the autumn, next come the summer, winter and spring cows. The average for the two last classes is the same.

Autumn cows do not perhaps calve at the season when the prices are highest, but they give the largest amount of milk. When the average annual milk production is considered, we find that the calving order in which cows should be classed is as follows, autumn, winter, spring and summer.

The average butter yields for the different calving seasons were: spring and summer: 236 lb., winter 258 lb. and autumn 268 lb.

Cows having their calves in autumn not only take the first place for annual production, but also produce most milk in the winter.

The cost of roughage is about the same, whatever the calving season may be, but the latter makes a great difference in the expense of concentrates and the total food expenditure, varies according to the price of the latter. On an average, the cost of concentrates is highest for cows calving in autumn, next come the winter cows, and last of all the spring cows.

According to the data based on the figures of several Associations and

referring to several years, the average total food expenses for cows calving in autumn, winter, spring and summer are respectively 67.39 — 63.16 — 60.10 — 56.73 dollars. These figures have, however, only a relative, not an absolute, value.

According to the study made on the effect of grazing upon the total food costs it would appear that the profits are not highest from dairy-farms with the best pastures, but that it is necessary to take the condition of the grazing ground into account in order to determine the most profitable calving period.

Effect of the calving month. — Cows dropping their calves in September, October, November and December give a large yield of milk and butter, those calving in April, May, June and July produce less ; further, cows calving in July yield the lowest average of profit.

Fig. 3 shows the average butter production according to the month of calving. It should be noted that the rapidity and regularity with which the annual butter yield decreases as the calving month approaches mid-summer is a little less marked than the speed and regularity with which it increases as the calving month approaches October.

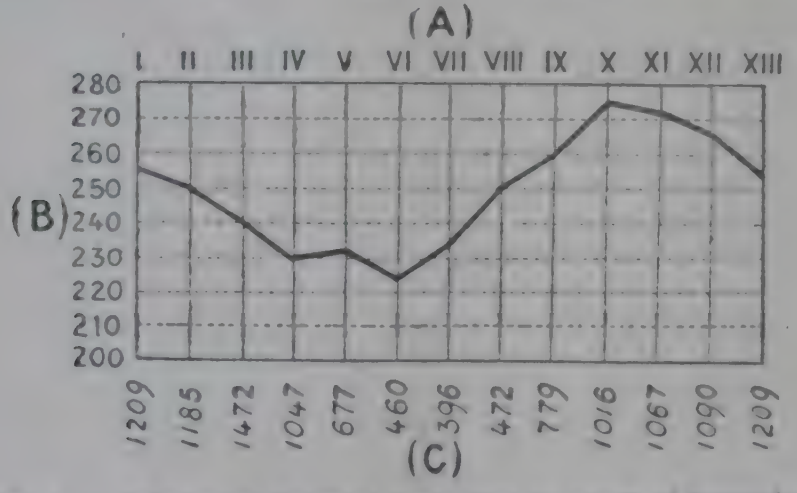


Fig. 3. — Relation of Butterfat Production to month of freshening.

A = Months of year.
B = Pounds of Butterfat.
C = Number of Crops.

From the averages obtained for 64 Associations, it seems that cows calving in the autumn and winter are those that give the highest milk and butter yields and the most returns (after subtracting the food cost). We may thus conclude, that as a general rule, it is most profitable to let cows calve in autumn and early winter, for although they eat more grains, they pay better owing to their higher yield.

IV. — Effect of yield, cost price per unit of production and value of product upon the profit per cow. — In order to make this study, the author has taken as a unit, the whole herd including the milch cows, bulls and young heifers By labour, he understands only the work

necessary for production. Food includes the food stuffs purchased and grown on the farm (forage, pasture-grass, milk) ; the general expenses include the interest and taxes on buildings, the expenses of upkeep, dairy utensils, heating, lighting, veterinary's fees and medecine, insurance, expenses entailed in the control of milk production, the upkeep of milking machines, expenses entailed in the sale of the cattle etc. The interest on the capital has been estimated at the rate of 6 % per annum on the value of the herds, buildings and apparatus of dairy-farm. The management expenses are 1s. per cow and per week, with a minimum of 20s. and a maximum of 60s. per week. The average daily yield per cow was calculated in this manner so that when this amount was multiplied by 365, the average annual yield per cow was obtained.

In the first table, the author gives both the average yield per cow and per day, and the total cost per gallon of the milk produced ; this comparison shows that there is very little connection between the average yield per cow, per day and the total cost per unit of production. The yield is, however, a very important factor for determining the net cost per unit production.

The variations in the net cost that are due to general expenses, interest, and management expenses are slight, although they do exist, whereas the effect of the cost of labour, food and rearing are more important.

The factors determining the cost of labour per unit of production can be studied by eliminating, as far as possible, the effect of the yield upon the cost of labour, which has a tendency to decrease as the size of the herd increases. It is clear, that it is also affected by the wages paid to the workers, the number of hours of work, the amount of work done per man etc., but when all these factors have been taken into account, it is seen that the labour cost per production unit depends more upon the size of the herd than upon the average yield per cow, per day.

The effect of the food factor cannot be studied separately from the cost of the animals' production, but the quality of the cattle must also be taken into account, that is to say, attention must be paid to the way the cattle utilise their food and to the cost of replacing old animals with low production by younger more profitable individuals. For this reason, the author has taken together the food cost and the production cost and called the total of these two factors the net food and maintenance cost of the herd of dairy cows.

When the total food and maintenance cost of the herd taken together and the food cost separately are compared with the total net cost per unit of production in farms where the average production per day and per cow were nearly the same, it is seen that a closer connection exists between the total cost of the food and maintenance of a herd and the total net cost of of the unit of production than between the unit of production and the cost of food considered by itself. It may be objected to this way of looking at the matter, that it does not show what feeding method is the most profitable The author, however, draws attention to the fact that conclusions based solely upon feeding costs would be of less value than those in which the cost of maintaining the herd were also taken into account, and that, in

the second place, the aim is not to reduce the food unit per production unit to a minimum, but rather to obtain the maximum profit from the farm as a whole.

The author also gives some instances showing that the relation between production cost per unit of product and the yield per cow per day cannot be a close one, since this relation may be altered by many factors some of which are the price of the food bought, the effect of the weather upon the forage crops, the commercial value of dairy cows ; and the sale price of the produce.

When we examine the relation between the net price per unit of product and the financial result of the enterprise, two new factors must be considered, viz., the cost of milk distribution and the value of the milk.

The distribution expenses have been settled for all the milk produced, and include the expense of labour, animal traction, mechanical traction and railway carriage. The total value of the product obtained has been calculated by adding to the returns from the sale of the milk the value of the milk consumed on the farm. In order to determine the financial result of the undertaking, the author has based his figures upon the profits per cow thinking in this way better to be able to take into account the effect of the yield per cow. The comparison of the figures given in the table sufficiently prove the effect exerted upon the profit per cow by the yield per cow, the net price per unit of production and the value of the product. The parallel between the data for farms No. 37 and No. 1 respectively show the amount of the returns, while that between the data of farms Nos. 36 and 50 prove the favourable effect of a low net cost, even when the yield is not high and the commercial value only average. The comparison between farms 6 and 19, on the other hand, bring out the effect of a rather high sale price.

TABLE I. — *Influence of yield, net cost per unit of production and of the value of the product upon the profit per cow.*

Farm	Average yield per cow per day	Cost of producing 1 gallon of milk	Sale price of 1 gallon of milk	Net profit per gallon of milk	Net profit per cow
	d. per gallon	*d. per gallon*	*d. per gallon*	*d. per gallon*	*d. per gallon*
36	1.68	13.71	23.34	8.56	21.4
35	1.93	23.40	32.61	7.49	21.8
1	1.73	15.12	23.45	6.27	16.6
37	1.92	16.99	23.44	6.05	17.8
6	1.68	18.85	24.54	4.15	10.5
19	1.67	20.64	26.06	4.50	11.7
20	1.93	14.30	23.89	8.00	23.3
35	1.93	23.40	32.61	7.49	21.8
36	1.68	13.71	23.34	8.56	21.4
50	1.49	14.57	23.14	6.85	15.8

A comparison of the net cost per unit of production does not give any exact information on the subject of the satisfactory condition of the different farms, because it does not take into account the sale price of the product nor sufficiently allow for the yield per cow ; even a comparison of the profits per unit of production may lead to a mistake being made, but in this case, the error is slighter, as it reduces the importance of the effect of the yield. On the other hand, a comparison between the profits per cow takes sufficiently into account the influence of the three important factors viz., the yield — the cost price per unit — and the value of the product . The highest yield and the maximum profit per cow do not always go together, and in many cases, the net profit per cow does not depend solely on the milk yield.

V. — An economic study of dairying on 149 farms in Broome County (State of New York). — Misner has examined the data furnished by 149 farmers in Broome County on the subject of their dairy farms. He made no choice of the farms, only discarding data from those where fewer than 6 cows were kept. The grains and forage produced on the farm were estimated at their market value minus the carriage and sale costs. The cost of transporting bought food was charged to the account for labour, implements, milk carriage and other expenses. The expenses incurred in moving the food from one place to another and also the loss of time entailed in taking the grain to the mill in grinding it were charged to the labour account. In order to estimate the net cost of grazing, the interest at 5 % on the value of the field was reckoned and the taxes at 0.5 % of the same value. The rent of fields for stock not belonging to the farm was deducted from the grazing costs. The cost of labour of milk transport, making or repairing yards and buildings was carried over to the account of milk transport, grazing and buildings. In addition, the labour account includes all expenses for milking, work on the dairy-farm, feeding the cattle, cleaning the cow-sheds, transport of food and litter, the sale and purchase of cattle, etc. On all the farms, the men's wages were calculated at the rate of 15 cents per hour, the women and children being paid 10 cents per hour. The work of horses was paid at the rate of 15 cents per hour.

All the expenses connected with milk-carts, the milk-cans and other utensils required for milk transport were entered under the implement account. Under the head " use of buildings " were entered : interest at 5 % on the average value of the buildings, the building and repair costs, the insurance and the deterioration in value. When the value of the buildings had increased by the end of the year, this increase of value was entered on the credit account.

For the use of implements and utensils the farm was charged interest at the rate of 5 % of the average value of the said implements and utensils for the whole year.

The interest on the average value of the cattle and of the food in the barns was calculated at the same rate.

All expenses incurred for veterinaries, medicines, disinfectants, ice,

mosquito-netting, white-washing, and milk-testing were included under the head of various expenses.

The value of the milk consumed on the farm was calculated by multiplying the weight of this milk by the average price of the unit of weight of all the milk sold at this farm. The heifer calves born during the year are placed to the debit heifer account: the bulls, calves for fattening and calves for sale are valued at their value when born. The price they fetch is credited to the cows, but is not included in the herd receipts.

The dung was estimated at 125 dollars per ton, not including its transport to the field.

The author adopted two methods for calculating the net cost of milk and butter production. According to one method, the whole herd was taken as a unit and all the receipts of the herd, except those derived from the sale of milk, were deducted from the whole sum of the expenses, the difference being regarded as the net cost of the milk or the butter. This cost calculated by this method is called the " net cost per herd ".

In the second method, the total expense per cow is subtracted from the receipts per cow excluding the price paid for milk sold. The bull expenses were placed to the debit account and the rearing of the heifers was considered separately. The net cost thus calculated is called the " net cost per cow ".

Size of herd. — In all the larger herds, the consumption of grains and green forage per cow was greater, and that of dry forage lower than in smaller herds. The yield of the latter was less in winter and the percentage of milk produced during that season was lower, so the trade in the latter was less intensive. The effect of the size of the herd is, however, best seen by the amount of work required per cow and per unit of production, this effect is most noticeable when the wages are highest. The relation between the size of the herd and the work per cow and per unit of production is shown in table II.

TABLE II. — *Relation of the size of herd to labour used per cow and per unit of production.*

Number of cows per farm							
6–10		10–14		14–18		above 18	
Hours of work per cow	Hours of work to produce 100 lb. of milk	Hours of work per cow	Hours of work to produce 100 lb. of milk	Hours of work per cow	Hours of work to produce 100 lb. of milk	Hours of work per cow	Hours of work to produce 100 lb. of milk
190.7	3.60	177.3	3.33	158.9	2.97	147.1	2.51

The maintenance cost per cow is lowest in the largest herds. Partly on this account, and also partly because of the better yield the cows of large herds are more profitable than those of small herds. In small herds, there is an average deficit of 8 dollars per cow, in herds of average size the deficit is 9 dollars, whereas in large herds there is an average profit of 7 dollars per cow.

Season of production. — As a rule, the grazing season began on May 14 and ended on October 19, thus lasting 159 days. The winter season lasted 206 days. In the herds, where the milk percentage in winter is highest the yield is best. This is due, to a large extent, to the cows calving in autumn and having been intensively fed, not to the greater milk producing capacity of the cows, although, these are probably better animals. Winter dairy-farms produce during the months of November, December and January as much milk per cow as during May, June and July, but summer dairy-farms produce ⅓ more milk during the last 3 months than during the winter. When more milk is produced in summer than in winter, less grains and green forage is consumed, but more dry forage is used, per cow and per unit of production. On summer dairy-farms, more food per unit of production is used in winter, but less in summer and the average for the whole year is less than that consumed on winter dairy-farms.

The hours of work per cow are less in summer than in winter dairies, but when the hours of work are divided by the units of production, the amount is about the same in winter and in summer dairies.

TABLE III. — *Relation between size of herd, season of production and hours of work per cow and per* 100 *lb. of milk produced.*

Percentage of milk sold during May, June, July	Number of cows per farm							
	6–10		10–14		14–18		over 18	
	Hours per cow	Hours per 100 lb. milk produced	Hours per cow	Hours per 100 lb. milk produced	Hours per cow	Hours per 100 lb. milk produced	Hours per cow	Hours per 100 lb. milk produced
Less than 33 %:								
Transport of milk.	15	0.25	16	0.30	22	0.42	14	0.23
Other work . . .	202	3.39	197	3.66	186	3.54	161	2.57
Total . . .	217	3.64	213	3.96	208	3.96	175	2.80
From 33 to 40 %:								
Transport of milk.	29	0.55	14	0.27	31	0.57	16	0.29
Other work . . .	186	3.51	167	3.16	150	2.78	139	2.50
Total . . .	215	4.06	181	3.43	181	3.35	155	2.79
Over 40 %:								
Transport of milk.	20	0.40	36	0.67	24	0.44	7	0.12
Other work . . .	199	4.02	170	3.19	136	2.51	125	2.33
Total . . .	219	4.42	206	3.86	160	2.91	132	2.45

In winter dairies where the farming is more intensive, the cows are of higher value and command higher prices when bought or sold. These cows are more frequently replaced than the inferior animals, and the percentage of heifers calving each year is higher; more calves are, however,

reared on the summer, dairy farms, but more cows are sold to the butcher from winter than from summer dairy-farms. On the latter, there are always fewer cows at the end than at the beginning of the year, whereas on the more intensive farms the number of animals increases. The production is not only lower on summer dairy-farms, but the average sale price per unit of production throughout the year is less than in winter dairy-farms. This explains why the difference is greater between the returns per cow for milk sold than between the figures for milk production in the case of the two kinds of farm.

Practically all the expenses are higher when a large percentage of milk is produced in winter, and the net cost of the milk and of the butter is also higher. Since, however, the sale price is also increased, the profit is not in proportion to the decrease in the net cost. When the net cost is calculated per herd, the loss per 100 lb. of milk is 12 cents in the case of winter dairies, 5 cents in that of mixed dairies (summer and winter production) and nothing in the case of summer-dairies. When the net cost per cow is estimated the losses for the 3 types of farm are respectively 9 cents, 5 cents, and 2 cents.

The net cost of milk reckoned per herd decreases more rapidly than that calculated per cow, because in winter dairy-farms there is a loss and in the summer dairy-farms a gain in rearing the heifers.

Finally, from the results of the whole comparison it is seen, that with the prices of milk, food and labour, as given in the present study, the dairy-farms producing most milk in summer are a little more profitable than those producing most milk during the winter. The author, however, draws attention to the fact that a change in the price of milk, food, or labour might invert this order, and that it is very possible that in other regions, or at another time, the most intensive farms might be the most profitable. On the other hand, on many farms where dairying is the principal work, the extensive system does not fully employ all the workers especially during the winter, whereas the intensive system provides more occupation throughout the year, and in the end brings in more money.

Foods and Feeding. — The author expresses the energy value of a food by a therm, which corresponds to 1000 calories (the amount of heat required to raise 1000 kg. of water one degree centigrade). When he speaks of energy, he always means the net energy of a food, that is to say, the energy available for metabolism which remains at the disposal of the animal after subtracting the energy necessary for mastication, digestion and nutrition. In this chapter, the author gives the name of winter dairy to dairies producing less than 36 % of their milk during May, June and July, reserving the term, summer dairy, for those establishments producing over 36 % of their total annual milk supply in the above 3 months. He also points out that when we study the relation between any change in feeding and production, the amount of food and the energy required per unit of production, the cost of production and the profits we must in the first place take into consideration the season at which the production is greatest.

When silage is fed to cows, they give more milk, provided the silage is given during the lactation period.

On intensive farms, the use of silage seems indispensable to economical production. When, however, the cows calve in the spring, equally good results can be obtained without silage. The economic advantages of the use of the latter depend as much upon the size of the herd as upon the intensity of the farming. When the ration includes silage, less nutritive substances are required per unit of production than when no silage is present. The difference is most marked in the case of the winter dairies. Herds fed silaged food also give more milk during the winter season which tends to decrease the amount of nutritive substances used per unit of milk produced in the winter. By comparing together the winter and the summer dairy farms and the herds belonging to both which receive and do not receive silage, it is seen that the net cost of milk is lower and the profits per cow are higher in summer dairies where no silage is fed and where the expenses, excluding the cost of food given in the shed does not exceed 50 dollars per cow.

As regards the use of grains for feeding herds of milch cows, it has been found that the larger the proportion of energy derived from the grains of the winter ration, the higher is the production, especially in summer dairies. In the same manner the cost of production per unit of product is lower and the profit per cows is higher when a large part of the energy of the winter ration comes from grains. Further, much more milk is also obtained per unit of the food expenditure. The increased milk yield due to the larger proportion of grains in the winter ration depends to a great extent upon the date of calving. A cow that has calved in the spring will not increase its milk yield, on account of an increased amount of grains in the winter ration in the same proportion as a cow that has calved in the autumn, and it cannot use grains to the same advantage as a cow that is at the beginning of the lactation period during the winter.

A larger proportion of grains in the ration not only increases the feeding cost, but also increases the other expenses ; with more milk more work is needed, while the amount of interest and depreciation per cow are increased.

The larger the amount of food given in winter, the less milk is obtained per unit of food cost and of food.

On summer dairy farms, less food is given in winter than on winter dairy farms, the difference amounts to about 3 800 calories per cow per day. Less concentrates, and fatty foods of inferior quality are also fed on summer dairy farms, the nutritive ratio being 1 : 7 : 7, whereas on the winter dairy farms, it is 1 : 6 : 7. The energy percentage supplied by the grains of the ration is 27 on summer farms, while on winter farms, the grains furnish more of the total energy from the ration, only a little being supplied by the roughage, especially by the dry forage.

Yield per cow. — In herds of average yield, the expenses are lower per cow, but higher per unit of production than in herds of high yield. No such exact relation exists between the net cost per herd and production, as between the latter and the net cost per cow. In herds with a low

yield, the net cost estimated per herd is lower than the net cost estimated per cow. This shows that in these herds, rearing heifers is profitable, whereas in the case of herds with a high yield, where the net cost calculated per herd is higher than that estimated per cow, there is a loss entailed by rearing heifers.

The profits are highest when the production is highest and the expenses of the food given in the cow-shed are lowest, on the other hand, on farms where the winter production is least and winter feeding is very costly the losses are greatest.

By finding the relation between production and intensity of feeding on the one hand, and the expenses and receipts on the other, it is seen that with a low yield the amount of food per unit of production is generally less than with a high yield ; further, a herd with a high yield consumes a larger amount of food per unit of production than a herd with good average yield.

If, however, the cows produce much milk at a time when milk fetches a high price, it may happen that in spite of the larger amount of food necessary per unit of production, that the increased value of the milk may compensate for the extra expenses entailed. This is the reason why the maximum profit per cow and per herd are not always obtained when the milk yield per food unit is highest. Generally, the maximum profits are obtained outside this relation.

An increase in production of 898 lb. per cow gave increased returns of $2.25 for each dollar of increased cost ; a further increase of 955 lb. gave increased returns of $1.67 per dollar of increased cost : a further increase of 1220 lb. gave only $1.44 per dollar of increased cost.

The author also draws attention to the fact that it is a mistake to calculate this limit by comparing the returns for the milk sold per cow with the food consumed by the cow minus grazing.

It is found, on studying the relation between yield and the season of production on the one hand, and the cost of production and the profits on the other, that in proportion as the production rises towards. the difference between the production cost and the profits is less marked in the summer dairy-farms than in the winter dairy-farms. In the former it is more difficult to obtain high returns ; further, most of the cows on these farms, calve in the spring, there is, however, a close connection between the value of the cow and the amount of milk she produces.

Cows belonging to farms where the yield is low and the milk production is high in summer have the lowest value, whereas those belonging to farms with high yield and more intensive production are the most valuable. On summer dairy-farms, the cows produce less milk per unit of value than the animals of other herds, but the heavy milkers are equally prized, whether their chief milk yield is in summer, or winter.

As regards the relation between the size of the herd, the season of production and the yield per cow on the one hand, and the production costs and profits on the other, it is seen that the cost of production and the losses are greatest in small herds with low yield and high production during the winter, whereas the large herds with heavy yield and a high

milk production in summer are those in which the production cost is least and the profits are the largest.

Fat content of the milk. — There is little difference in the amount of milk produced in summer by herds yielding milk with a different average fat content. Table IV shows the relation between the fat content on one side, and the production and the season of production on the other.

TABLE IV. — *Relation between the fat content, the milk yield and the season rpoduction.*

Average fat percentage	Yield of milk per cow	Percentage of milk sold during May, June and July
%	lb.	%
3.6	5844	31
3.9	5495	34
4.1	5092	36
4.4	5271	34

The expenses and receipts per cow are larger in herds where the fat content is high than in those where it is low. In herds where the fat percentages is lowest, the receipts are equivalent to the expenditure, but in herds giving milk richest in fat there was a loss of between $4 to $8 per cow. The relation between the fat content and the expenses and returns is given in the following table.

TABLE V. — *Relation between the fat content and the expenses and returns.*

Fat content of milk	Total expenses per cow	Total returns per cow	Loss per cow	Cost of production reckoned per herd	Cost of production reckoned per cow
	dollars	dollars	dollars	$ per 100 lb.	$ per 100 lb.
Below 3,5 %	110	110	0	1.71	1.69
From 3.5 to 4 % . . .	108	101	7	1.77	1.75
From 4.1 to 4.2 % . .	103	95	8	1.77	1.78
Above 4.2 %	105	101	4	1.80	1.77

Heifer rearing. — In this chapter, the author reckons two heifers as one cattle unit. The figures quoted per cattle unit may be regarded as very nearly representing the expense entailed for rearing a heifer up to the age of two years. The number of heifers on a farm is not always in proportion to the number of adult cows, but the system of feeding and managing the heifers depends perhaps more upon the number of cows than upon the number of heifers. The latter are fed more intensively in the large herds, and received more milk, grains, silaged foods and dry forage in herds of over 18 cows than in those where there are only 6-10. In large herds, heifers are estimated higher than in small herds, and probably turn into better cows, since they belong to a superior herd and are better fed. Table VI shows the relation between the number of heifers reared and the labour cost of rearing a heifer up to the age of 2 years.

TABLE VI. — *Relation between the number of heifers reared and the labour costs of rearing a heifer up to the age of 2 years.*

Average number of heifers per farm	Labour cost according to different rates of pay per hour				
	15 cents	20 cents	25 cents	30 cents	35 cents
4.7	$10.38	$13.84	$17.32	$20.76	$24.22
11.5	7.16	9.54	11.92	14.31	16.70

On all the summer dairy-farms, the heifers are given less food, and especially less silage, than on the winter dairy-farms, but the amount of labour remains the same, no matter how much milk is produced in the summer. Practically, however, all the expenses and returns per heifer are lower on summer than on winter dairy-farms, but there is a little difference in the value at calving-time. The number of heifers in proportion to cows is greater in small herds and on summer dairy-farms.

It may be said that, generally speaking, heifers cost less to rear in herds with low yield than in those in which the milk production is higher, this difference being greater on winter than on summer dairy-farms. The expenses are lowest on summer dairy-farms with little production and highest on winter dairy-farms with large output.

Bull-rearing. — The expense of old bulls is greater than that of young animals, and the net maintenance expenses of old bulls are much heavier both per unit of cattle and per head. Usually, the herds are too small, the farming system too intensive, the value of the animals bred and of the milk too low, and the winter feeding cost of the bull too great to allow of the latter being kept beyond the second service year, unless in the case of a pedigree animal.

It costs little more to use a good bull in a larger herd, than to keep an inferior bull in a small herd. In the latter, the bull is fed less grains, silage and dry forage and more milk than in a large herd, and its maintenance entails more work.

When the dairy-farm is run on more intensive lines, there is a tendency to use superior bulls and to feed and treat the bulls better, therefore naturally the maintenance expenses are higher.

The difference in the percentage of milk produced during the summer does not affect the proportion of bull-calves to adult bulls; but the latter are given less grains, dry forage and whole milk on summer dairy-farms, for on these, all the chief expenses for the maintenance of breeding animals are lower, while on the other hand, the difference between the outlay and returns is less and the maintenance cost are less.

Rearing calves and bulls for fattening. — In the large herds the calves to be fattened receive less milk and are also sold at lower prices which gives the idea of their being got rid of younger. In very small herds, the percentage of calves for fattening is higher than in large herds, but in the

latter, the calves sold for fattening fetch higher prices, so they are probably older.

There is no relation between the season of milk production and the amount of milk used for fattening calves. On summer dairy-farms a little more skim milk is given which reduces the net cost of fattening the calves. Fat calves from summer and winter dairy-farms sell for about the same price, but the average price of calves for fattening is higher in winter dairy-farms.

137. Factors Influencing the Percentage of Fat in Milk.

WOODWARD, T. E. (Dairy Experiment Farm, United States Department of Agriculture, Beltsville, Maryland) *Journal of Dairy Science*, Vol. VI, No. 5, pp. 466-478. Baltimore, 1923.

The author having previously found that feeding dairy cows a ration of prickly-pear fruits decreases the fat content oi the milk in direct production to the number of fruits consumed, wished to make further experiments to determine the effect produced by the different constituents of the fruits viz., the water (of which they contain a great deal), the calcium, magnesium and phosphorus (only small quantities of the latter are present).

On feeding rations containing respectively the proper amounts of barley-meal, calcium carbonate, magnesium carbonate, or Epsom salts, or composed also of water and of large or small quantities of the constituent minerals, the author was unable to observe any alteration in the fat percentage of the milk. The cows were also fed large amounts of cotton seed cake and linseed cake (3 to 5 kg.) and of gluten (2.7 to 3.4 kg.). In the first cases a decided rise in the fat content was obtained, but the gluten had no effect. The results produced, even when linseed oil was substituted for linseed cake, were only temporary, so it may be assumed that the increase was not due to the protein (given the negative effect of the gluten), but to the oil, since the action of the linseed oil and the linseed cake was the same.

The author also conducted further experiments to discover the effect exercised by moderate work on the fat content of cows' milk ; he found that the fat percentage was increased slightly but undoubtedly ; this agreed with the results obtained by STROBELE (who also stated that moderate work also increased milk yield) and with the findings of : KIRCHENER, FLEISCHMANN, DECHAMBRE, MALPEAUX, STILLICH and SPALLANZANI who however noted a decreased milk production. The author's conclusions are at variance with those of MARLIN, MAIOCCO, CORNEVIN, THIERRY, and DIFFLOTH, for these investigators, maintain that although excessive work greatly reduces the milk yield and the fat content, moderate work decreases the milk production only very little, but does not raise the fat percentage.

The author found that the fat content fell during the hot season, especially in the case of breeds yielding milk with a high proportion of fat. This effect of heat is therefore more noticeable in the case of

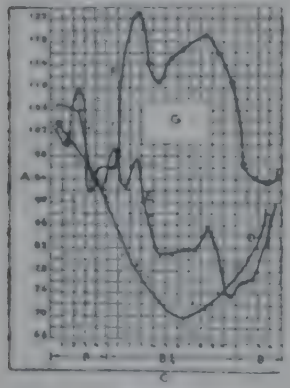
Jerseys and Guernseys than in that of Holsteins. Winter and summer milk tests reveal no appreciable difference in the milk of Holstein dairy cows. G. Tg.

138. The Effects of Underfeeding on Milk Secretion.

RAGSDALE, A. C. and TURNER, C. V. (Department of Dairy Husbandry, University of Missouri, Columbia, Missouri) *Journal of Dairy Science*, Vol. VI. No. 4, pp. 257-259, 2 diagrams, bibliography. Baltimore, 1923.

ECKLES and PALMER had already discovered by means of their experiments on dairy cows, that the fat content of milk could be increased by reducing the food ration. The same effect was obtained either by reducing the total necessary quantity of food, or by cutting down (even to the point of physiological malnutrition), the ration of an over-fed cow when, as a result of the excessive functioning of the milk-secreting and milk yielding organs, it was impossible to satisfy the animal's voracity by giving it a reasonable supply of food. The fat content increased when the ration was most reduced, and the increase in fat was particularly notice-

FIG. 1. — *Effect of reducing the ration one half for* 10 *days, on the average yield and composition of the milk of* 3 *cows.*

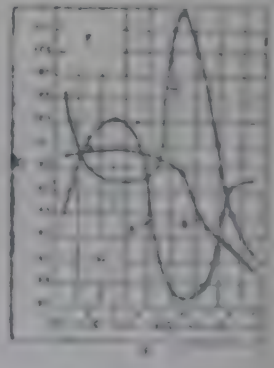


A = Percentage of normal production.
B = Full ration.
B ½ = Half ration.
C = Days.
D = Milk.
E = Absolute fat.
F = Percentage of fat.

Fig. 1.

FIG 2 — *Effect of three days ½ ration on the average yield and composition of the Milk of 8 cows.*

A = Milk.
B = Absolute fat.
C = Percentage fat.
D = Full ration.
D ½ = Half ration.
E = Days.
G = Percentage of normal production.



Fig

able in cases where the cow had for a long time previous to the experiment been fed a ration far exceeding its needs.

RAGSDALE and TURNER repeated these experiments with special attention to the possible control of milk production. They employed 2 lots of dairy cows, one consisting of a Jersey, a Holstein-Friesian and an Ayrshire, and the other composed of 8 cows : 4 Jerseys, 3 Holsteins and one Ayrshire. The animals were chosen in different periods of lactation, and after a preliminary course of normal feeding, were given half rations for some days, returning later to the original ration. It was shown by all the experiments, that a 50 % reduction of the ration produces a distinct rise in the fat percentage of the milk, the maximum increase being obtained about the third day of feeding the reduced ration. The fat percentage then continued to remain abnormally high for the succeeding days of under-feeding, and fell with the return to the normal ration.

The total amount of milk underwent a reduction that proved to depend both upon the length of the experiment and upon the lactation stage, as a rule, the cow giving most milk felt the effects of underfeeding to a greater extent than cows with a lower milk yield. In any case, however, the total amount of fat present in the milk did not vary to any significant extent, for the percentage increase was not sufficient to compensate for the total decrease due to the decrease in the secretion.

These experimental results are also shown in the characteristic diagram

The effects of underfeeding must therefore be taken into account in interpreting the data obtained from experiments of the kind made by the authors and also in administering drugs, for in the latter case, it is necessary to change, and especially to reduce the nutritive ration. They should also be taken into consideration whenever milk production is to be tested. G. Tg.

139. **Milk Production in Algeria and Morocco.**

I. — CANAC JEAN and PORCHEREL J. Hygiène et production du lait sur les hauts plateaux de l'Algérie. *Le Lait*, Year 3, No. 9, pp. 704-709. Lyons, 1923.

II. — PERODEAUD, G. L'Industrie du Lait au Maroc. *Le Lait*, Year 3, No. 9, pp. 710-712. Lyons, 1923.

I. — According to statistics, there are in Algeria 1 093 000 head of cattle of which $^{9}/_{10}$ belong to the natives. The breeds met with are : French breeds that have become acclimatised and yield on an average 2 600 litres of milk annually. The Tarantais, Montbéliard and Schwytz breeds are those that do best under these new conditions ; *b*) native breeds especially the Guelma breed ; by means of selection, or by crossing, the average annual milk yield of the latter has been raised to 1 800-2 000 litres. The Breed Commission are of opinion that excellent results will be obtained from the selection of the Guelma native breed.

The dairy industry is especially developed in the neighbourhood of towns with a large number of European and native inhabitants. As a rule, the conditions of hygiene and feeding leave much to be desired,

but the colonists have introduced considerable improvements. The author passes on to describe M. LEVY's breeding farm, where every attention is paid to matters of hygiene and questions of health. The cattle belong to the Schwytz , Franc-Comtois, and Friburg breeds, or are hybrids resulting from mating Arab cows with Schwytz or Friburg bulls. The average weight of the cows is 400 kg., the lactation periods lasts 300 days and the milk yield is 2600 litres.

The rations vary according to the time of year and are fed thrice a day, at 4 a. m., midday, and 6 p. m. From January to March, viz. during the winter months, the animals are not turned out to graze, but receive 16 kg. green barley, 4 kg. bran, 4 kg. hay, 6 kg. straw. From April to July, they graze and are fed 40 kg. lucerne, 3 kg. bran, 2 kg. hay and 1 kg. straw. From October to December, they graze and are fed 40 kg. maize silage, meadow hay 4 kg., bran 4 kg., sugar-beets 20 kg., hay 2 kg., straw 5 kg. The calves for breeding purposes have their dam's milk for 15 days, after which it is replaced by a gruel of hard wheat, 75 to 80 %, rice-meal and linseed meal 20 to 25 %. This mixture is boiled and mixed for the first month with skim milk, later, the latter is replaced by water. Milking is done twice a day, morning and evening. The milkers are all healthy, clean native women. After filtering, the milk is sent twice a day into the town, the coolest hours being selected for its dispatch.

II. – The milk industry in Morocco is still in its infancy, in spite of the large number of cattle kept in the country. Most of the milk is supplied by the native cows, as these animals cost little to buy and to keep. The animals live under very unfavourable hygienic conditions, and are scantily fed owing to the poor pasturage. The cows are milked morning and evening ; cleanliness is little considered and the milk is watered to a large extent. The cows yield an average of 600 litres of milk during a period of about 4 months ; when 7 years old they are fattened and sold to the butcher. The European breeders own better dairies and import cattle of the Breton, Norman, Dutch, and Montbéliard breeds. These cows give as much as 3000 to 3500 litres of milk annually, but there are difficulties in acclimatising the animals, and a certain number are lost. Excellent results are obtained from crosses between the native cows and imported stock, provided there is sufficient grass when the animals are turned out the pastures in the spring. The calves are given their dam's milk for 15 days, and are then allowed to graze, being fed a supplementary ration of bran and hay ; this mode of weaning answers very well, for these hybrids are strong and hardy.

All skimming must be done in a very cool place ; the butter yield is satisfactory. It takes on an average 21 litres of milk to make 1 kg. of butter. The cream has to be cooled quickly before churning and the butter is coloured afterwards.

Calves and young pigs fed on the skim milk grow rapidly. Owing to the want of cellars and of cold storage plant, practically no cheese is made in the country (1). P. D.

(1) See *R.* 1922, No. 8. 12-2-24. (*Ed.*)

140. The Feeding of Calves.

I. — MAYNARD, L. A. and NORRIS, L. C. (Department of Animal Husbandry, Cornell Univerity, Ithaca, New York). A System of Rearing Dairy Calves with a Limited Use of Milk. *Journal of Dairy Science*, Vol. VI, No. 5, pp. 483-499, bibliography of 3 works, diagrams 5. Baltimore, 1923.

II. — MCCANDLISH, A. C. (Dairy Husbandry Section, Iowa State College of Agriculture and Mechanic Arts, Ames, Iowa). Studies in the Growth and Nutrition of Dairy Calves. The use of the Self-Feeder with Young Dairy Calves. *Ibidem*, Vol. VI, No. 5, pp. 500-508, bibliography of 5 works. Baltimore, 1923.

I. — REARING CALVES WITH LIMITED USE OF MILK. — The authors, who wished to make a systematic study of the results obtained by feeding calves on special rations devised for the express purpose of dispensing as soon as possible with milk, conducted two sets of experiments: Se-

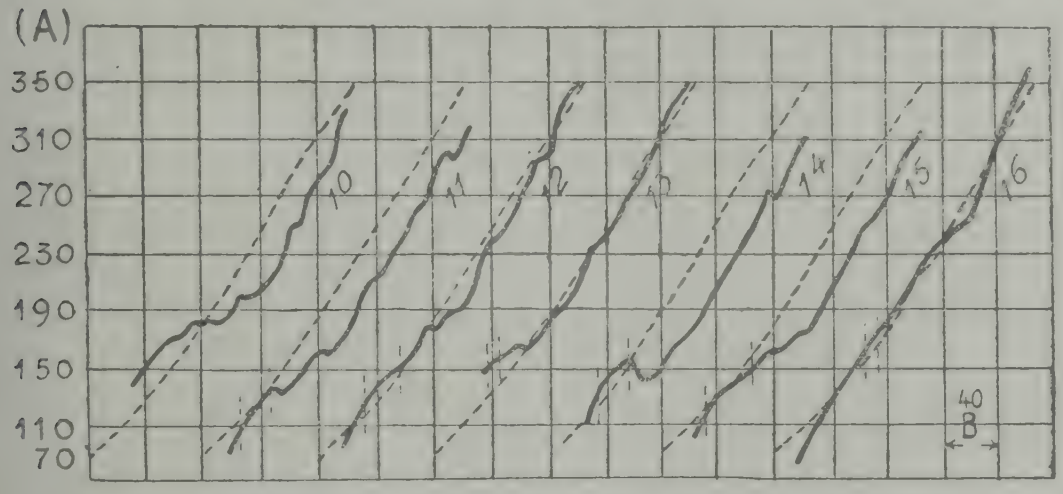


FIG. 1. — *Curve of growth in weight of Holstein heifer calves* (*Series* A).

The dotted curves represent normal growth according to the data obtained by ECKLES. The perpendicular dotted lines mark the period of change from milk diet to the ration devised by the authors.

ries *A* on 6 half-bred Holstein calves, and Series *B* on 8 pure-bred calves, 6 being Holstein and 2 Shorthorns. The animals were fed a ration consisting of 25 parts, by weight, of maize, 25 of ground wheat-germs, 15 of cleaned ground oats, 5 of linseed cake, 10 of malted, ground barley, 10 of blood-meal (entirely soluble in water), 1 of precipitated carbonate of lime, 1 of pure, precipitated bone-meal and 1 of common salt. The whole mixture was given in the form of a mash (in 5 times its weight of water to the calves, the change from an exclusively milk diet being effected gradually, at about the 4th week. The animals had also at their disposal, hay of good quality (lucerne, or clover), but they ate only a certain quantity when they were 7 or 8 weeks old. In addition, the calves were fed twice a day a mixture of threshed maize, ground oats, wheat bran, and cotton seed cake (3 : 3 : 3 : 1). The calves of series

B received in addition a few carrots, except in the case of one Shorthorn which was given beetroots instead.

The authors plotted growth curves, weight curves, and curves of height at withers for all the calves used in the experiments and compared

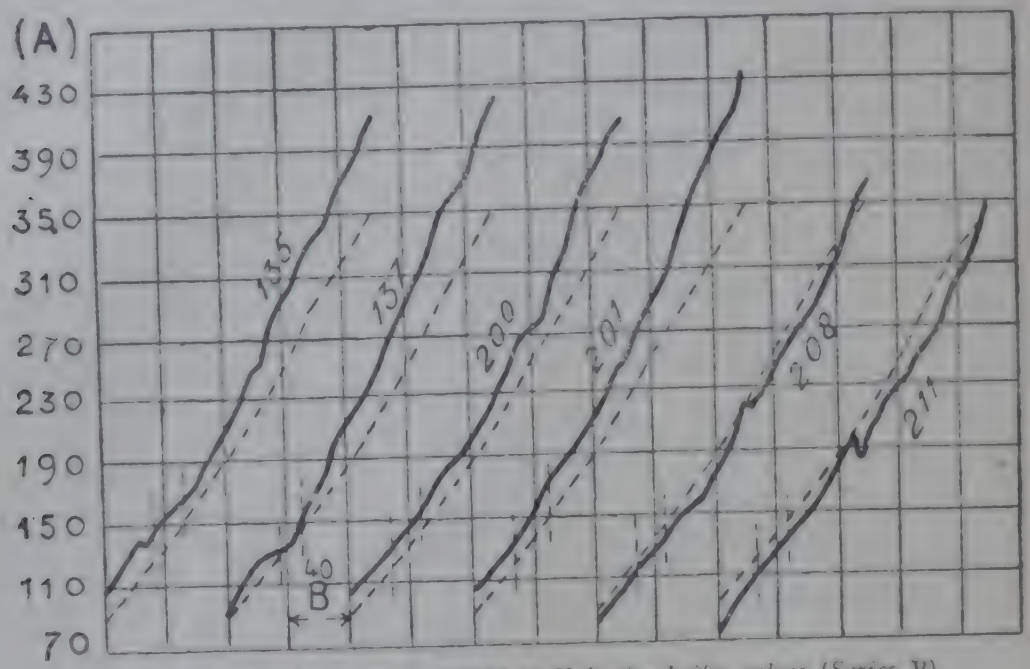


FIG. 2. — *Curves of growth in weight of Holstein heifer calves (Series B).*

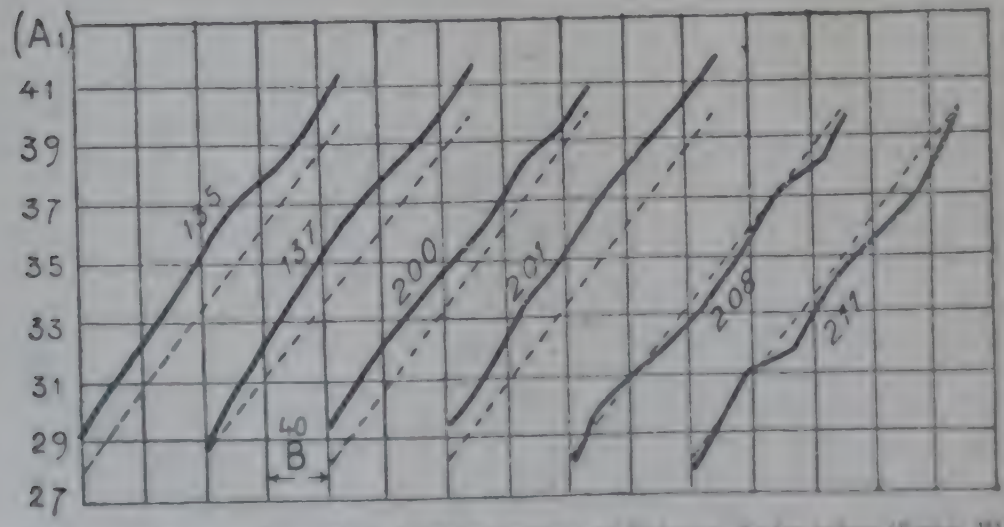


FIG. 3. — *Curves of growth in height at withers of Holstein heifer calves (Series B).*

them with what may be termed, the normal curves obtained by ECKLES in the course of experiments on numerous herds of calves in Missouri that had been fed on skim milk, grain and hay from the 2nd week until they were 6 months old. In figure 1, it is seen that during the period of change of diet the weight curves of the animals in Series A, except in the case of

calves 12 and 16, differed from the normal curves obtained by ECKLES which shows a cessation or delay of growth, but as the authors point out, this period as well as the following 4-5 weeks, fell during the hottest month of the summer (except in the case of No. 16). In the case of the Holsteins of Series *B*, figs (2) and (3), the weight curves and the corresponding skeletal development followed a somewhat parallel course. As compared with ECKLE'S curves, they showed no variation during the period of the milkless diet.

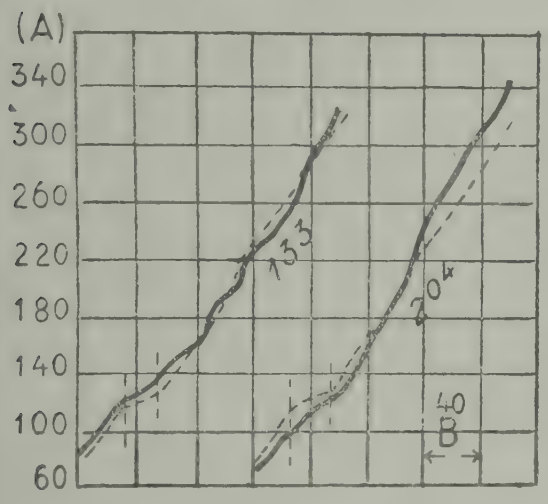


Fig. 4.

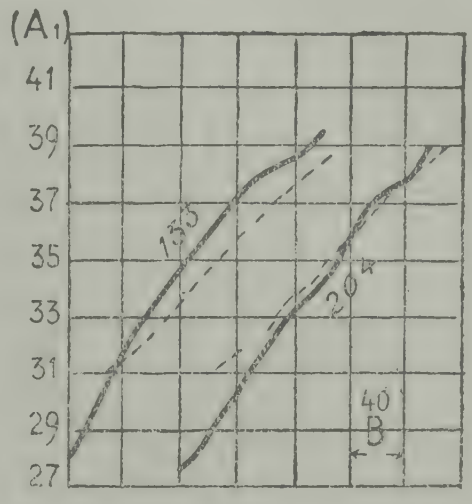


Fig. 5.

FIG. 4. — *Curves of growth in weight of Shorthorn heifer calves* (*Series* B).

FIG. 5. — *Curves of growth in height at withers of Shorthern heifer calves* (*Series* B).

The dotted curves represent normal growth according to Eckles data.

B = period of 40 days.

In Fig. 4 the vertical dotted lines mark off the period during which the change was made from milk to gruel.

In Fig. 5 the curves begin at age 30 days.

The curves plotted of weight and height of withers in the case of all the calves except Nos. 208 and 211, showed greater development at about the 6th month than the curves with which they were compared. This increased growth was to be expected in the Holstein because the change in diet corresponded with more favourable seasonal conditions than those obtaining during the experiment with Series *A*, while the animals were carefully selected and given carrots which possibly remedied the deficiency in vitamines characterising the rest of the ration. The daily gain in live-weight was 0.652 kg. in the calves belonging to Series *A* (this figure agreed with ECKLE'S estimate), while the Holsteins of Series *B* gained as much as 0.770 kg. The 2 Shorthorns of the same series gained the same amount as the Holsteins (see figs. 4 and 5).

The authors wish to carry out some further experiments of this nature, after which they will give the data respecting the quantity and cost of the rations consumed. They are of opinion that although the ration adopted by them can well be used as a substitute for skim milk in case of ne-

cessity, it cannot compete with the latter, for skim milk is the best and most economical food for calves.

II. — The Use of the Self-Feeder for Young Dairy Calves. — The author, taking as his basis the studies of Eward, Jordan, Fain and Jarnagin, Kildee, and Otis upon the appetising qualities of certain foods, tried to discover how far calves were able to select the rations necessary to supply their needs . The investigators also noted the preference shown by the animals for various concentrates and their salt and water requirements. The experiments were conducted on two calves, an Ayrshire and a Holstein, of the respective ages of 37 and 30 days both having an initial weight of 50 kg., and upon one Guernsey calf which was 30 days old and weighed 66 kg. The experiment was divided into 2 periods each lasting 30 days. At first, the total amount of milk needed by the calves was left at their disposal, but later whole milk was replaced by skim milk. The food was placed in different divisions of the self-feeder so that the animals could choose what they liked, and consisted of shelled wheat, crushed wheat, ground oats, whole oats, ground maize, linseed cake, wheat bran, wheat gluten, salt and charcoal. The calves had also free access to lucerne hay of average quality and for a few hours a day to water. The animals showed a decided preference for whole grain as compared with crushed grain and ate linseed cake much more readily than wheat bran ; they did not like the gluten or the coarsely ground maize as much. The calves showed a capacity to alter their consumption of concentrates to meet their needs, thus, when skim milk was substituted for whole milk, they ate more protein concentrates, in the form of wheat and oats. In this case, they consumed a ration which was proportionally more nutritive than that prescribed by the rules of stock-feeding. According to the modified Wolff-Lehmann feeding standard, the nutritive proportion of the ration during the first period should have been : 1 : 4.3 and during the second period 1.4 The nutritive proportions of the rations consumed by the calves were, however, 1 : 3.4 and 1 : 3.5. In this case, the animals were quite right, for they increased rapidly in weight without putting on too much fat. The calves evidently needed salt and charcoal and also water even when they consumed large quantities of milk.

Table showing the amounts of food required for a live-weight increase of 100 kg.

	Period I	Period II
	kg.	kg.
Whole Milk	554	353
Skim	102	353
Grain	[illegible]	[illegible]
Hay	[illegible]	[illegible]
Drinking-water.	233	350
Total of dry matter . . .	176	241
» » water	795	1015

The average daily increase in live-weight was 0.997 kg. for the Guernsey, and 0.874 kg. for the Ayrshire and Holstein. The amounts of food required to produce 100 kg. of increase in live-weight are shown in above Table. G. Tg.

141. **Feeding Experiments with Groundnut Oil Cake.**

DAVISON, W., and NARASHIMHA IYENGAR, B., *The Journal of the Mysore Agricultural and Experimental Union*, Vol. V, No. 2, pp. 65-81, pl. 8. Bangalore, 1923.

A series of experiments was made at the Rayankere Dairy Farm, with calves divided into two lots, one fed on wheat bran and the other on bran and groundnut oil cake, coarse fodder such as straw, green grass or silage being the same for all the animals. Records of the weights of the various groups were kept.

Results indicate that a mixed ration of bran and cake is preferable to either pure bran or pure cake fed separately. It appears that in the early stages, the nature of the concentrated feed is not of such serious consequence as later. M. L. Y.

142. **The Domestication of the African Buffalo.**

LEPLAE, EDM. Het Tam- en Dienstbaar-maken van de Afrikaansche Buffelsoorten. *Onzeploeg*, Year 3, No. 1, pp. 15-16. Louvain, 1924.

The author describes the 2 species of buffalo found in the Belgian Congo : the black Cape buffalo and the wild, red buffalo. He mentions the domestication experiments made on 4 red buffaloes at the Api Station, and the encouraging results obtained. P. D.

Sheep.

143. **The Bizet Sheep.**

I. — PORCHEREL, M. Le Mouton Bizet. *Revue de zootechnie, la revue des éleveurs*, Year 3, No. 1, pp. 19-23, figs. 3. Paris, 1924.

II. — LAFOREST, G. (Directeur des Services agricoles de la Haute-Loire). Le Concours spécial de la race ovine des Bizets. *Revue de zootechnie, la revue des éleveurs*, Year 3, No. 1, pp. 24-26, figs. 3. Paris, 1924.

I. — The Bizet sheep represents the wealth of the regions of Cantal, Haute-Loire and Lozère. Since the creation of the breed, selection has been the only method of improvement adopted. In Cantal, and Haute-Loire, the size of the flocks varies according to the extent of the grazing grounds at the disposal of the owners, who are farmers, or " metayers ". The average flocks consists of 50 to 100 head, but its composition depends or the richness of the pasture and the economic conditions of the breeders. Some of the latter own both ewes and castrated sheep, while others only keep animals for fattening which can be replaced several times a year if the pastures are sufficiently fertile. The possessors of small holdings keep only ewes. The author gives a long description of the Bizet

sheep and points out the differences in the conformation of the male and female. In Haute-Loire, two very distinct types are found : *a*) the *Black Bauns sheep* with very convex profile ; it grows tall and large owing to the high phosphoric acid content of its grazing grounds ; *b*) the *Cruzy Bizet*, a shorter animal (50-60 cm.) varying in weight from 30-40 kg. As a rule the Bizet is well adapted to the climate, being thrifty and strong ; its mutton has a delicate flavour and is appreciated on the French markets. The breed is very prolific ; the lambs are dropped in December, January and February (March in the Cantal). On an average, each ewe has 2 lambs ; the milk is used for rearing the lambs till they reach the age of 5-6 months. During the summer, the animals remain in the field, except when it rains heavily. In winter, the flock is kept on the farm, but the sheep are let out at daybreak. In the evening, the sheep are given leaves that have been prepared during the summer. 30 kg. provide two meals for 100 head. The nursing ewes are fed a little hay. The Bizet is essentially a mutton breed, the animals are fattened and sold at the age of 6 to 12 months. The breeding rams are sent to the butchers when 4 years old, the ewes being kept until they are 5 or 6 years old. When in good condition, they weigh 50-55 kg. The sheep are sold in in the summer as they can be fattened on the pasture at small expense. The wool and skins are set apart for special purposes.

II. – The author gives the official standard of the Bizet sheep as required at Shows, and also the official scale of points. Sheep-breeders attach much importance to the colour of the fleece and the position of the white patches. Mention is made of the present crisis in Bizet sheep-breeding. P. D.

144. The Weight of Lambs at Birth.

LAPLAUD, M. and DUFFAU, A. Étude sur le poids des agneaux à la naissance. *Revue de Zootechnie*, Year 2, No. 11, pp. 320-326 and No. 12, pp. 416-425. Paris, 1923.

The authors conducted their experiments on four out of the five flocks of sheep at the stock-breeding centre of Vaulx-de-Cernay, near Paris. These flocks are severally composed of Southdowns, Charmois (two lots), early maturing Merinoes and the Meymac-Limousin breed resulting from an industrial cross with Southdowns in 1920-21 and the Charmois breed in 1921-1922. The experiments of the authors were carried out in order to determine : 1) the weight and chest girth of lambs at birth ; 2) the influence of the parents ; 3) the effect of sex ; 4) the extreme weights ; 5) the effect of twin births. The animals were classified according to weight. The total data obtained indicate that the normal weight of lambs at birth is from 2.5 kg. to 4 kg. in the case of the Southdown and Charmois animals and also in that of the Southdown × Limousin and Charmois × Limousin hybrids, whereas the early-maturing Merinoes weighed from 3.5 kg. to 4.5 kg.

The average weight at birth of Southdown and of Charmois lambs was 5 to 10 % higher in the male than in the female lamb, but at the

case of the Limousin × Southdown and the Limousin × Charmois hybrids, the average weight of the ram and ewe lambs was the same. The weight at birth expressed in grams varied from 9 to 11 times the chest girth expressed in centimetres as is shown in Table I.

TABLE I. — *Girth of Chest in Lambs at Birth.*

	Ram Lambs			Ewe Lambs		
	Average girth	Extremes		Average girth	Extremes	
		minimum	maximum		minimum	maximum
	cm.	cm.	cm.	cm.	cm.	cm.
Southdown	36.1	28	42	35.1	21	39
Charmois (1st flock) .	35.5	30	40	34.0	29	39
Charmois (2nd flock) .	34.7	27	40	34.3	27	39
Merinoes	36.5	26	44	36.6	31	43
Limousins.	32.6	28	39	32.8	28	40

From the prolific point of view, the sheep are classed in the following order : Limousins, Charmois, Southdowns, Merinoes. A large percentage of the Southdown and Merino ewes bore no lambs, but as a compensation there were many twins. In the Charmois and Limousin flocks, there were usually as many, or more, lambs than ewes, Table II gives the percentage of twins in 1921-22.

TABLE II. — *Percentage of Twins.*

Year	Southdowns	Charmois (flock 1)	Charmois (flock 2)	Merinoes	Limousins
1921	9.7 %	2.4 %	—	—	10.3 %
1922	10 %	5.7 %	8.5 %	18 %	31 %

The largest percentage of twins were found among the Charmois × Limousin hybrids after which come the Merinoes and then the Southdowns. The authors state that twins are most profitable when the ewe is a good nurse and food is plentiful. The Merino ewe is the least good nurse, next comes the Southdown, while the Charmois and the Limousin sheep both have a plentiful supply of milk. The weight of the lamb was on an average $^1/_{15}$ of the weight of the dam, or $^1/_{10}$, it the latter was in bad condition. The proportion of the weight of the lamb, as compared with that of the sire, varied considerably, ranging from $^1/_{18}$ to $^1/_{28}$.

According to the authors, it is very important to have flocks in which the animals are as homogeneous as possible, especially in weight, for this insures homogeneity in the lambs and reduces to a minimum the

proportion of lambs below the average weight of the breed which are always inferior to the other animals of the same age.

The breeder should make every effort to insure the lambs reaching the average weight of the adult sheep in as short a time as possible

G. Tg.

Pigs.

145. The Basal Metabolism of a Growing Pig. (1).

DEIGHTON, T. (Institute of Animal Nutrition School of Agriculture, Cambridge). *Proceedings of the Royal Society*, Series B. Vol. 95. No. 668, pp. 340-355. figs. 4, bibliography. London, 1923.

The experiments described by the author are to a certain extent a continuation of those already conducted on the same lines by J. W. CAPSTICK and T. B. WOOD (1).

A young pure-bred, Large White pig that had been castrated at the age of 45 days was employed in the author's experiments. The animal was removed to the Institute when about 2 months old at which time it weighed about 13 kg. The pig was kept in a pen outside, and only taken indoors during the coldest weather and for a few days before the experimental tests. In order to make the pig quiet at the beginning of the tests, and also on the first day it was placed in the calorimeter, it was fed half its daily ration in the morning and the other half in the afternoon, while during the fasting period of one week, the animal was only given water. At the conclusion of each experiment, the pig was again taken out of doors and fed full rations.

Like CAPSTICK and WOOD, the author found the metabolism continued to decrease (falling gradually to its basal value), about 80-100 hours after the last meal had been eaten; further, the maximum assimilation energy was registered 5 hours after the said meal; this tallied exactly with the results obtained by LUSK in his experiments on dogs. In order to compare the metabolism curves obtained by the different experimentors, it is necessary to calculate the basal metabolism in calories per m^2 of surface, using for the purpose MEEHS' formula:

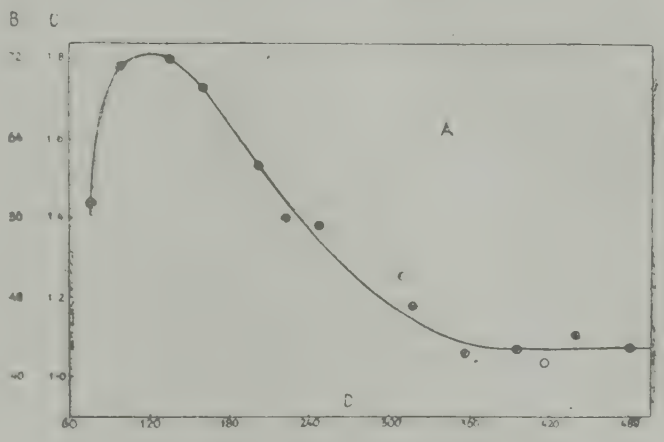
$$\text{surface} = K\ (\text{weight})^{\frac{2}{3}}$$

The value of the constant K, in the case of a young pig is 9.02 according to VOIT, and 8.7 according to RUBNER. The two DU BOIS have improved this formula for human subjects, but MEEH's version must still be employed for pigs. The author has for the present taken 9 as the value of K. The diagram in the figure shows the metabolism per surface unit in the case of a growing pig. The course of the curve is generally the same as that obtained by E. F. DUBOIS in his experiments on man, for the metabolism seems to fall at the end to a value somewhat higher than half the maximum figure recorded during the earliest periods

(1) See *R.* July-September 1923, No. 410. (*Ed.*)

of growth (4 months in the case of the pigling, and 5 years in that of the child). Variations in the curve appear, however, to be possible (Armsby and Fries, Tigersted). The daily metabolism of the pigling seems to be estimated by the writer at 1032 calories per m^2, a figure somewhat higher than that obtained by Capstick and Wood (906 calories), which may be explained by the fact that the animal used by the latter investigators was fed more liberally and had therefore become fatter than Deighton's pig. Voit obtained a higher value: 1075 calories (half Meissl's figures), and Tangl found a series of values for different pigs ranging from 900 to 1200 calories per day and per m^2. In any case, individual variations in this respect undoubtedly exist in the case of piglings, just as they have been found to do in that of man. (Gephart and E. F. Du Bois).

Basal metabolism per surface unit of growing Pig.



B = Metabolism calories per hour per sq. metre.
C = Metabolism actual reduced in accordance with $^2/_3$ power of weight.
D = Age in days.

From the practical standpoint, the author has observed that the basal metabolism represents the amount of energy calories an organism must be given for its maintenance, and possibly for its development, and since the metabolism per surface unit is not constant during the growth period of the animal, the above-mentioned numbers of calories cannot be estimated solely and strictly according to the surface of the body as is generally done. G. Tg.

146. **Mineral Assimilation and Growth in Swine.**

Dudley, H. A., Godden, W. and Brock, R. M. The Influence of Cod Liver Oil, Linseed Oil and Olive Oil on the Assimilation of Calcium and Phosphorus in the Growing Pig. *The Biochemical Journal*, Vol. XVII, No.6, p. 707-719. London, 1923.

The authors used in their experiments young pigs from 2 to 4 months old which could well be compared together as regards weight. Every precaution was taken to obtain a proper balance between the calcium and phosphorus.

The basal ration was fed the pigs in the form of a thick mash made with distilled water; it consisted of the following substances in the given proportions: maize-meal 10, bran 10, oat-meal 10, blood-meal 1. The

extreme poverty of this ration in lime should be observed, the percentage of lime was only 0.061. The animals had distilled water at their disposal for drinking. The authors conducted three consecutive experiments, and in each, they gave one of the pigs cod-liver oil, while the second and third pigs were fed olive oil and linseed oil respectively. The first experiment was divided into 3 periods: *a*) a preliminary period during which pigs Nos. 28 and 24 were given 1550 gm. of the basal ration + 50 cc. of a 20 % solution of calcium chloride, while No. 26 received 1240 gm. basal ration + 50 cc. 20 % solution of calcium chloride; *b*) the actual experimental period when the oil was introduced into the above ration in doses of 40 cc. per day; *c*) the final period, when the rations were the same as in *a*).

A progressive increase in the calcium balance was observed throughout the experiment. In the second experiment, the preliminary period was longer; Nos. 68 and 70 were fed 930 gm. of the basal ration + 50 cc. of 20 % solution of calcium chloride; No. 67 had: 1240 gm. of the same ration + 50 cc. of 20 % calcium chloride solution. At the end of the 19th day, the pigs showed a negative balance as regards calcium. Then, 40 cc. cod-liver oil were added to the ration of No. 67, and 30 cc. olive-oil to that of No. 68, No. 70 continued to be fed the original ration for 14 days longer after which it was given, in addition, 30 cc. of linseed oil. The addition of the oil had the effect of at once restoring the positive calcium balance of the pigs. In the 3rd experiment, Nos. 669 and 671 received 930 gm. basal ration + 50 cc. 20 % solution of calcium chloride, No. 670 had 930 gm. basal ration + 26 gm. of lime and 5 gm. chloride of sodium. On the 12th day, 8 gm., of tricalcic phosphate were substituted for 6 gm. of lime to balance the phosphorus content of the ration.

The authors reached the following conclusions: An exclusive diet of grains decreasest he organism's capacity for absorbing and retaining calcium and phosphorus, whereas the addition of cod-liver oil, olive-oil or linseed oil increase the absorption and retention of both the above elements. When the animal has sufficient calcium and phosphorus in its system, the effect of the three oils is the same, but if there is a negative balance of calcium, the addition of cod-liver oil, or of olive-oil, at once makes the balance positive, whereas the action of linseed oil is slower. Where there is a deficiency of calcium, the taking of cod-liver oil gives rise to digestive troubles. The beneficial effect exerted upon the assimilation of calcium and phosphorus by the addition of any one of these in a ration composed exclusively of grains appears to be due to the oil itself, and not to depend in any way upon the amount of vitamine *A* present in the oil. P. D.

147. The Effect of Deficiency of Iron in the Diet of Pigs.

McGowan, J. P., and Crichton, A. [Rowett Research Institute, Aberdeen]. *The Biochemical Journal*, Vol XVII, No 2, pp. 214-227. Cambridge, 1923.

In a previous paper, published by Elliott, Crichton and Dale in 1922, attention was drawn to the importance of inorganic constituents

in food in connection with rickets in pigs. The authors emphasise the fact that iron may also play an important part in the growth and development of these animals.

The milk of swine contains 0.009 % of iron as compared with 0.002 % in cow's milk and it may be concluded, *a priori* that there is greater need for storing up iron in the body during the suckling period. HESS, UNGER and SUPPLEE have shown that the iron content of milk varies with the feed of the animal. Cow's milk contains double the quantity of iron when the animals are fed on pasture than when fed on a mixture of bean meal, linseed meal, hominy, gluten meal and bran, together with dried beet pulp, molasses and straw.

In a large breeding establishment for pigs, the authors observed certain symptoms in pigs 3-4 weeks old. These symptoms proved fatal, and sudden death was frequent (red blood corpuscles about 3 000 000 per mm^3; haemoglobin 15 %). The sows were kept on pasture until 15 days before farrowing and were then shut up and fed on white fishmeal, bruised maize and brewers offal, together with an abundant supply of water. This ration, however, lacks iron. When large doses of ferric oxide were given, first to the mothers and then to the pigs when large enough to feed themselves, the cases of sudden death ceased at once.

The authors consider it probable that this disease, according to the observations made (symptoms and post-mortem appearance) corresponds with that caused by cotton seed poisoning, common in the United States; and treated with beneficial results by WITHERS and CARRUTH by using iron salts. The enzootic hepatitis of pigs referred to by HUTYRA and MAREK (1913) and which caused great losses in Russia and Eastern Prussia resembles closely the disease described. G. Tg.

148. **Self-Rationing in Swine.**

EDGE, S. F. On Self Feeders *Live Stock Journal*, No. XVIII, No. 2585. p. 375. London 1923.

The author reports the results of some of his feeding experiments with pigs which he allowed to feed *ad libitum* on the various food-stuffs placed at their disposal.

The first animal was a Middle White sow with 8 piglings (4 male and 4 female,) which was permitted to consume at will white fish meal, wheat middlings, ground maize germs and barley meal. This diet was begun during the first week after farrowing and the piglings followed the example of the sow as soon as the condition of their digestive system made it possible. All the family grew most satisfactorily, the average weight of the young pigs at the age of 13 weeks being 32.4 kg. This self-rationing was continued even after the piglings were weaned. One of the male porkers was kept on the farm while the rest of the litter were afterwards sold at a high price, and one of the young male piglings was awarded a prize at the Tavistock and Yeovil Shows.

The author found, by means of subsequent experiments, that the younger piglings ate a larger protein ration that those that were older.

The live-weights of the piglings (Middle Whites), belonging to four other litters were as follows:

Letter of	7	piglings	average	weight	22.8	kg.	in	11	weeks	and	5	days
»	»	8	»	»	26.8	»	»	»	»	»	4	»
»	»	10	»	»	»	»	»	»	»	»	6	»
»	»	12	»	»	»	»	»	»	»	»	4	»

Therefore, it required altogether, 11 $\frac{1}{2}$ weeks to produce 0.65 kg. of live-weight. G. Tg

Poultry.

149. **The Rate of Senescence of the Domestic Fowl as Measured by the Decline in Egg Production with Age.**

BRODY, S., HENDERSON, W. and KEMPSTER, H. L. *The Journal of General Physicology*, Vol. VI, No. 1, pp. 41-45. Baltimore, 1923.

The reduced egg-production of the domestic fowl as it grows older, whether due to a gradual exhaustion of the supply of the oocytes, or to the decrease in the vigour of the organs and tissues regulating egg-laying, or perhaps to both causes combined, may be regarded as a sign of senility, so that the number of eggs produced is an index of the rate at which senescence is proceeding. The authors have collected many data on this subject from which they have constructed the following equation: $Et = Ae = kt$ (1), in which Et is the egg production at a given age t, while e is the basis of the logarithm, A and k being constants. This equation shows that the total annual egg-production (independent of the age of the hen), is a constant percentage of the number of eggs laid by it in the preceding year.

Decreased egg production in proportion to age of fowl.

Age years	No. of birds	Annual egg-production from Nov. 1-Oct. 1	
		Found	Calculated (1)
1.	222	158	158.5
2.	221	140	140.1
3.	222	124	123.9
4.	222	110	109.6
5.	193	95	96.9
6.	28	89	85.7
7.	2	71	75.7
8.	6	63	66.8

(1) Calculated from the equation $y = 158 \cdot e^{-0.145t}$, where y is the annual egg-production of a fowl at age of t.

Thus, by dividing each annual value by the value immediately preceding it, we always obtain the quotient 88, that is to say, the annual egg-production is always 88 % of the egg-production of the previous year, or in other words, the percentage decrease is constant and the rate of senescence of the tissues, or organs, regulating egg-laying follows a definite law. A similar law, as equation 1 shows, also governs monomolecular chemical reactions ; thus, we are induced to believe senescence to be a physico-chemical process determined and limited by chemical reaction.

The average number of eggs laid by fowls living long enough for the senescence reaction represented in the preceding equation (1) to be complete would be the number (see preceding table), of eggs laid from the beginnimg of the egg-laying period ($t = \frac{1}{2}$ year), to the time when the senescence reaction is finished ($t =$ infinity), and hence, this theoretical number would be obtained by integrating the equation (1) between the limits of ½ year and infinity which gives the result of 1369.

The number of eggs (1369) that the hens in question could theoretically produce is much less than the oocysts present in the birds ; according to R. CURTIS quoted by PEARL (*Maine Agric. Exper. Station Bull.* 205, 1912), the oocysts visible to the naked eye are 1814 in number which would incline us to believe that the diminished egg production is due to the lessened vigour of the organs, or tissues, governing oviposition, rather than to the supply of oocysts becoming exhausted. G. Tg.

150. " Guabiroba ", a New Brazilian Breed of Fowls.

SCOTTO DOS SANTOS, A. Guabiroba, una nova raça de galinhas nacionaes. *Chacaras e Quinteas*, Vol. XXVIII, No. 5, pp. 397-398. São Paulo, 1923.

After 10 years' selection of the descendants of a cross-bred Orpington cock (with Dorking plumage), mated to three ordinary hens, Dr. E. GASTAL, has succeeded in obtaining the race of the Mediterranean type " Guabiroba " which was greatly admired and gained a prize at the VII Agricultural Exhibition of Rio Grande do Sul. The cocks of this race weigh 3.5 kg. when a year old, and the hens of the same age weigh 2.5 kg.

F. D.

151. Are Spurs a Disqualification to Hens ?

VOITELLIER, C. (Prof. de zootechnie à Institut National Agronomique) L'ergot chez les poules est il une cause de disqualification ? *La Revue avicole* Year 33, No. 8, pp. 249-255. Paris, 1923.

The author quotes the opinions of various expert stock-breeders as to the correlation between fertility and the assumption of secondary masculine attributes in hens, and concludes that the presence of spurs on hens should be regarded as a defect comparable to any other external malformation in the birds. Recent experiments, especially those conducted by PEZARD, seem to prove without any doubt that the masculinity of certain turkey-hens is due to ovarian insufficiency. Dr. LARCHER'S investigation seem show that when the ovary no longer exerts its influence upon the organism owing to absence, a condition of physiological rest, atrophy or

disease, the secondary male characters show themselves in the females of different birds, especially in those of certain species. Therefore the author is of opinion that since show-birds are always judged from the utilitarian standpoint, hens with spurs ought to be disqualified, however excellent their other characters may be. G. Tg.

152. **Improved Methods of Killing Poultry.**

Sacrificio y preparación de ls aves. *El Estanciero*, Year XIII, No. 311, p. 17. Montevideo, 1923.

After drawing attention to the disadvantages of the usual methods of killing poultry (wringing the neck or cutting the throat), which cause the blood to coagulate inside the bird, spoil its appearance and may result in infection of the wounds, the author advises piercing the brain with a large needle, or the points of the scissors inserted in the middle of the palate, and cutting the large veins at the base of the latter which is easily do with a pair of scissors. Death is instantaneous all the blood runs out, and the fowl is more easily plucked. Further, all the above disadvantages are avoided. The author subsequently deals with drawing, plucking, chilling, preparing for the market and packing fowls. J. P. C.

FARM ENGINEERING.

Machines and Implements.

153. **Note on the present Position of Motoculture in Great Britain and the Colonies.**

Gray, W. S. (*Technical Adviser, International Institute of Agriculture*, Rome) (1).

The farming industry in Britain as a result of the fall in prices since the war, is in a difficult position and any means by which the cost of production can be reduced or the output increased deserves careful consideration, especially as the prosperity of the farming community in all countries is essential to the welfare of industry and labour in general. One of the first means to present itself is that of the use of power, machinery and motor-driven implements as aids to the various operations on a farm.

(1) The views expressed in this article are those of some leading authorities in Britain, in addition to the writer's personal knowledge of that country and of some of the Colonies.

Motoculture is not opposed in any way by labour in Britain, as its advantages are realised, but until there is a more intelligent use of tractors and machinery the advance in mechanical tillage will be slow.

Great developments took place during the later years of the War and continued until two years ago, but since that time the rate of progress has been less marked, in fact, the number of tractors in use at present seems to be diminishing rather than increasing, and this is often due to lack of knowledge of machinery and engineering on the part of the farmers, who, as a rule will not pay a higher wage to a tractor driver than to an ordinary farm labourer. The result of this policy is that the tractor is not skilfully driven, the repair bill is heavy and motoculture falls into disfavour.

In districts where farms are large, mechanical tillage is general, but in smaller farms of from 150 to 200 acres, the tractor is not such a good proposition, especially where horses have fallen to pre-war values, or even less. Tractor cultivation became popular about four years ago, to supplement the shortage of labour, now, however, there is no such shortage and the tendency is to return to the use of horses and also to restrict the area of arable land until markets are more favourable for farm produce. The cable system of steam tillage is still the favourite method of power farming in some countries and with many farmers in Britain.

There is, at present, no cooperative movement for the purchase of tractors or machinery.

The Government has not given any assistance to farmers in respect to credit for the purchase of tractors, but it is possible to raise loans for land improvement purposes and an Act has been passed to afford loans to farmers who are in need of assistance, and it might be assumed that such facilities would apply to all branches of farming.

Tractors are generally more in favour on light than on heavy land, especially where intensive work in done, as in potato-growing areas, where on fine, sandy land a light type of tractor is suitable. Some heavy land farmers find them valuable in working summer fallows.

In the Dominions and Colonies conditions differ widely from those in Britain ; very large, level areas have to be cultivated where labour is often scarce or costly and then motor-tillage is advantageous. On the other hand, where the land has steep gradients or is situated at comparatively great altitudes the tractor loses power and is inefficient.

An extreme case of this is the highlands of Kenya, of which the writer has had personal experience, where there are large areas of good land situated at a height of from 6000 to 9000 feet. On one large estate there were five 75 H. P. Holt tractors, but the loss of power owing to the altitude and steep gradients was such that they were abandoned. Better work was done by a light tractor, but it was found that under those conditions it was more economical to employ oxen, although the output per team was only ½ acre per day.

Motoculture is an entirely economic question and one to be decided by the individual farmer after careful consideration of the local conditions and his own requirements.

154. The Use of Agricultural Machines in Czecho-Slovakia.

Published by the Ministry of Agriculture of the Republic of Czecho-Slovakia, Year IV, No. 3, pp. 21-23. Prague, 1923.

Czecho-Slovakia has 160 factories of agricultural machines with an output of over 150 million crowns. The production not only supplies the home market, but also an export trade as the following figures show:

Statistics of the use of agricultural machines have been kept since 1922. The figures are summarised in the following Table:

	Imports				Exports			
	1920		1921		1920		1921	
	quintals	millions of crowns	quintals	millions of crowns	quintals	millions of crowns	quintals	millions of crowns
Engines	10.666	21.3	6,290	11	5.716	12.5	7.314	11.7
Steam ploughs	3.057	5.5	2.96[illegible]	2.9	1.827	3.0	1.762	2.1
Threshers	2,903	2.9	4.362	8.7	14.607	14.6	19.941	39.8
Two-shares ploughs (at least)	3.013	2[illegible]	2.104	4.2	38.801	29.0	63.490	126.9
Seeders	252	0.181	519	1.03	45.711	35.1	30.540	61
Reapers	1.711	1.3	1.201	3.0	11.354	9	4.458	11.1
Dairy machines	3.636	21.8	4.644	18.6	506	2.4	469	1.8
Various	3.957	2.9	8.018	10.5	23.273	18	29.914	104.6

The machines mentioned are driven by:

Group	Men	Oxen	Wind	Water	Steam	Electricity	Other power
I	85 485	5 032	59	81	482	1	4
II	139 467	17 492	110	408	1 399	8	17
III	92 035	43 608	78	924	1 999	14	11
IV	79 514	65 838	45	1 024	3 237	19	23
V	39 274	38 864	47	439	2 280	17	21
VI	2 348	2 562	2	49	528	6	2
VII	2 580	2 924	6	111	1 678	19	15

Prof. BRDLIK calculates that before the war, the sum of 137 crowns per hectare was expended on agricultural machine work. Now, an effort is being made for the co-operative use of agricultural machines and implements, already in 1918, 136 agricultural machine co-operatives were in existence.

In the Czech districts, even small farms are well provided with agricultural machines, but it is quite different in Slovakia, where wooden ploughs are still much used, and farm implements are drawn by men, or animals.

R. D.

Groups	Area of farms	Tractor ploughs	Manure distributors	Seeders	Rakes	Reapers	Threshers	Reapers	Chaff-Cutters	Cream separators	Crushers	Seed separators	Maize hullers	Presses
I	Less than 2 hectares.	—	24	3 533	37	45	9 271	171	67 216	133	2 344	27 748	28	24
II	2–5 hectares . . .	1	49	6 280	79	177	38 950	495	118 220	244	2 476	66 267	83	44
III	5–10 hectares . .	—	92	10 954	284	385	62 721	715	35 281	289	2 544	63 701	59	36
IV	10–20 hectares . . .	4	170	22 079	1 924	2 104	75 706	1 107	81 482	540	3 570	67 224	47	45
V	20–50 hectares . . .	16	393	16 559	5 036	5 101	40 592	1 057	42 723	610	3 223	35 204	37	66
VI	50–100 hectares . . .	21	216	1 774	1 251	1 035	2 414	260	2 727	100	486	2 241	15	23
VII	Above 100 hectares .	321	1 035	2 797	2 527	1 942	2 467	724	2 996	323	1 010	2 689	32	112

155. **Tests carried out in Germany by the Federation of the Agricultural Machine-Testing Stations.**

Mitteilungen des Verbandes landwirtschaftliches Maschinenprufungsanstalten. *Die Landmaschine*, Yera 3, No. 29, pp. 360-365; No. 30, pp. 375-382; No. 34, pp. 429-432; No. 37, pp. 461-464. Berlin, 1923.

Prof. MARTIGNY describes the good results obtained during the trials made from August 7 to 9, 1922 near Würzburg with two 25-30 H. P. ploughs of the small Man and Stock types. The tests included shallow and deep ploughing, deep ploughing combined with breaking up the stubble, and breaking up a field of lucerne. The soil was average as regards compactness and moisture and the ground was inclined (slope of 7 %).

The Man type broke up the stubble and ploughed 0.352 hectare per hour to a depth of 20 cm.; if the depth was only cm., it ploughed 0.475 hectare per hour; the Stock type's record was respectively 0.341 and 0.41 hectare per hour. The average amount of fuel consumed was respectively 16 and 14.5 kg. per hectare.

The author also describes the Krause pipe-irrigation system which has been on trial for the last 3 years in the meadows and gardens belonging to the Halle Station. The pipes are manufactured at the Mannesmann Röhrewerke at Düsseldorf.

The very satisfactory results confirmed those already obtained by the "Deutsche Landwirtschafts-Gesellschaft".

The system consists of: 1) a series of fixed pipes provided with valve-cocks placed at intervals of 12 m.; 2) a series of portable pipes inserted perpendicularly to the first; 3) a set of movable pipes 6 m. long carrying the irrigation cocks. The last set of pipes is affixed alternately to the right and the left side of the perpendicular pipes, so that while one side is operating the other is being made ready. The movable pipes are so light that they can be affixed by women, or boys; they slip into their places on the application of a slight amount of pressure. The water falls in fine spray and thus does not injure the physical condition of the soil.

Prof. E. MEYER and O. SCHNELLBACH (engineer) give the results of tests carried out at the Hohenheim Station with the threshing-machine "Parole No. 4" made by the "Ceres Maschinenfabric A. G. vorm. Felix Hübner of Liegnitz (Würtemberg). It is a machine that works on a large scale and has a straw shaker, but no seed-sieve. It is driven by a 7.5 H. P. electric engine with alternating current and threshes per hour 1135 kg. of oats in sheaves, obtaining 327 kg. of grain, with a consumption of 0.58 kilowatt-hour. The oats although still damp were threshed in a perfectly satisfactory manner. This machine can be used for wheat and deals with 705 kg. of sheaves per hour, threshing 340 kg. of grain with a consumption of 0.52 kilowatt-hour. It also threshes barley, beans, peas and poppy-capsules.

Prof. MARTIGNY has tested the sower "Bandsaat" made by the firm of Franz Kranefeld and Co. of Berlin; he suggested certain improvements in the shares. The trials were carried out at the Halle Station.

F. D.

156. **The Graetzin Heavy Oil Generator** (1).

Die Landmaschine, Year 3, No. 33, pp. 416-418, figs. 4. Berlin, 1923.

The Graetzin Heavy Oil Generator is worked by a combination of the two systems of pre-heating and of finely dividing the fuel from which the gas is to be obtained. The heavy oil is emulsified by air and re-heated, which causes the evaporation of its volatile constituents and an increased tension in the emulsified mixture. The increase in tension is used for the transport, in the chief air current of the generation, of the fuel in the form of a finely-divided spray (vapour carrying with it a cloud of heavy oil).

This gas-generator has been tested in driving heavy engines and a saving of 40 % in the fuel cost has been obtained. F. D.

157. **Experimental Production of Straw Gas.**

ROETHE, H. E. (Associate Development Engineer, Bureau of Chemistry). *U. S. Department of Agriculture, Department Bulletin*, No. 1203. Washington, D. C., 1923.

The Bureau of Chemistry of the Ministry of Agriculture of the United States has studied the question of manufacturing gas on the farm from the straw and other products that are generally wasted on farms in America.

The gas obtained is well adapted for lighting and heating purposes, but the cost of production is prohibitive. R. D.

158. **A New Windmill Electricity-Generating Plant.**

The Implement and Machinery Review, Vol. 49, No. 581, pp. 570-571, figs. 2. London, 1923.

On the lines indicated by the Technical Service of the Ministry of Agriculture (England), Messers TELFORD, GRIER and MACKAY Ltd., Glasgow, have constructed a windmill-electric plant that should meet the requirements of a farm. Special attention has been paid to the protection of the gearing from damp, and to the retention of the lubricant with the result that the machinery only needs lubricating once a year (2) R. D.

159. **Mechanical Appliances for Industrial Vehicles.**

I. JULIEN, Freins et embrayages à butées. (Brakes and coupling gears with projections). *Recherches et Inventions*, Year 4, No. 1, pp. 49-53. Paris, 1923.

II. IDEM, Benne de Véhicle basculant sous un effort de recul. (Basket of vehicle that is Inverted by return action). *Recherches et Inventions*, Year 4, No. 41, pp. 53-55. Paris, 1923.

This new system which is applicable to all the usual types of winding brakes (whether band-brakes, or those made of articulating segments),

(1) See *R.* Oct. Dec. 1923, No. 733. (*Ed.*)
(2) See *R.* 1923, No. 279. (*Ed.*)

has been specially devised in order to obtain equal brake-power when the part to be checked rotates in either direction and with the same force exerted in the same manner by the controlling gear.

Brakes of this construction, for instance, when attached to motor-vehicles of all types and to the vehicles towed by them, exercise the same controlling force during reversed and forward action.

The new method is characterised by the use of two projections that are independant of the pace to be checked and of the so-called brake-gear. The work of these projections is to form a fixed point of support at any given moment for either winding-band upon which, according to the direction of rotation, the restraint is exerted.

Figure I shows the brake disengaged, figure II shows it acting in one direction (for example A V), figure III shows it acting in the oposite direction (A R).

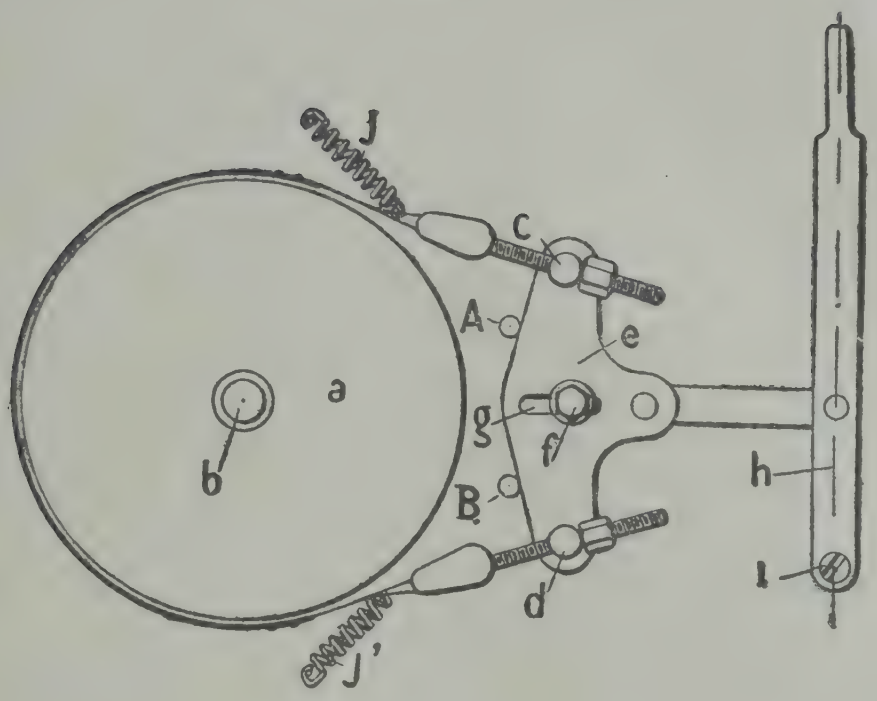
In these figures: *a* is the rotary part to be checked; it is set in motion by the motor-shaft *b*; *c* and *d* are the respective ends of the band-brake, *e* is a whipple-tree to which are affixed the two bands that can turn and slide on a fixed pin *f* fastened into the block *g* and moved by a hand-lever to which it is articulated and which itself pivots around the point of attachment *i*. When not in action, the band is kept disengaged by two antagonistic springs, *j j*, which draw back the whipple-tree and bring it into contact with the two projections, A and B, that are symmetrically disposed on either side of the axial plane *bf*. When the rotatory part on which the brake is to act turns in the direction shown (fig. 2), the pressure exerted by the operator on the lever *h* (measured for instance by the opening angle *O*) is shown by a simultaneous pull on the two arms of the whipple-tree and hence on the two rolling bands which are thus exposed to the friction of the drum, which carries round the band *d* and its corresponding arm of the whipple-tree which comes in contact with the projection B, and rests against it, whereas the other arm and the other band are still subjected to the action of the brake-lever.

If the part to be checked were turning with the same force in the opposite direction to that shown in fig. 3, the same amount of brake-power (angle *o*) exerted by the operator on the same lever *h* in the same direction, would cause the other arm attached to band C to assume a similar position on the projection A, since the checking force is practically the same in both cases.

The distance between the projection A and B is larger, or smaller, according to the amount of brake power required, the slowing down energy to be produced, or the blocking to be effected (the maximum check with very little force is obtained when the projections are very close to the pivot *f*). If this distance is equal on either side of the axial plane *bf*, the power exercised by the brake is equal, in the case of movement in both directions. The position of the projections can be so varied as to allow of maximum unequal force being used in both directions of rotation. It is unnecessary to add that the projections do not in any way prevent the use of progressive brake power.

This type of brake action has been devised by its inventor for use on

FIG. 1.



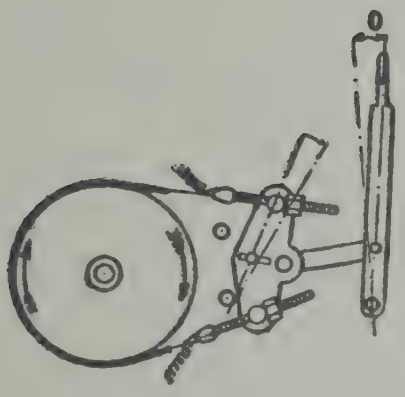


FIG. 2.

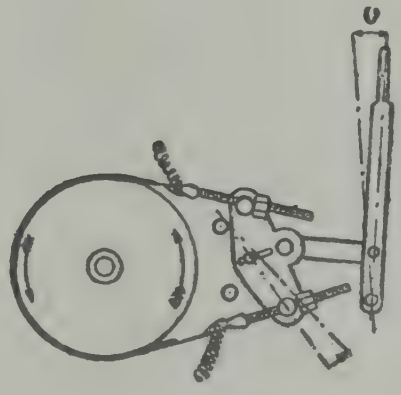


FIG. 3.

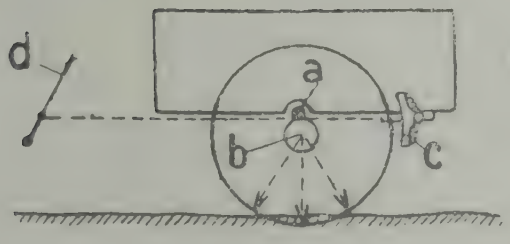


FIG. 4. — Brake disengaged.

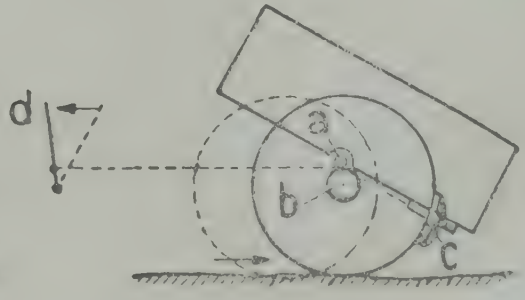


FIG. 5. — Brake acting in one direction.

a manure lorry with a balance basket worked by the backward motion if the lorry which allows of the reverse action being regulated with the necessary precision.

II. This new balance arrangement for baskets, boxes and platforms has been devised for a new type of rural motor tractor, a " manure lorry " or " manure tractor " especially intended for the transport of manure, soil, and crops, and for general transport on cultivated land and country roads. It is characterised by its platform, or box, mounted on a pivot upon the chassis of the tractor, or vehicle in tow. It can be attached at the moment required to the wheels carrying it, so as to move backwards simultaneously with the backward motion of the lorry. Figure IV shows the box of the vehicles on the chassis ; it is balanced between the two wheels and its centre of gravity passes as near as possible to their axes. Figure V, shows the operation of attaching the box to the wheels which by their rotation as they move back cause the balance motion. In the figures : *a*) is the axis of the pivots which are attacked to the chassis (not represented), on these pivots are mounted the supports of the box ; *b*) is the axis of the wheels which are the driving-wheels of motor vehicles and of the fore-carriages of tractors, and may also be the wheels of a vehicle that is been towed and is rigidly coupled to its tractor. This brake is provided with a patten, and runs in a slide carried by the box and worked from the forepart of the lorry, by means of a hand-lever, *d*, for instance.

The apparatus works as follows : while on the road, the box is kept in the position shown in figure IV. When the vehicle has reached the place for unloading, it is stopped, the pattens are tightened and the vehicle is made to move back and the pattens are fixed on the wheels which carry them down with the box to which they remain solidly attached.

The return action of the vehicle is stopped (this is done by the band-brake already described), as soon as the inclination of the basket is sufficient to allow it to discharge its load, either wholly, or partially. In order for the return movement of the vehicle and the inversion of the box (which needs an additional, but proportionally slight amount of force), to be carried out simultaneously, it is necessary for the motor-wheels to be able to grip properly if they are working on damp, or loose, land such as cultivated fields, roads with many ruts, in forests, or quarries. For this reason, these vehicles were always provided with wheels of large diameter, fitted with permanent land-grips able to work equally well in both directions. **(American, English, German patents).**

160. **Hand-Worked Garden Tractor.**

DESSAISAIX, R. Tracteur horticole à bras. *Revue Horticole*, Year 95, No. 24, pp. 542-543, figs. 2. Paris, 1923.

M. CH. PITOIS (Condray-Montceaux, France), has invented a small hand-worked tractor. It has two wooden wheels 0.95 m. in diameter which are affixed to an axle and are 0.50 m. apart. The wheel-rims are bound with T-shaped irons 0.045 m. in height ; these form the gripping-irons of the machine which weighs 150 kg. The naves of both wheels carry

rachet-wheels that can be turned in one direction by pawls articulated with a frame turning in the vertical plane round the axis. To this frame is attached a lever of which the length can be regulated and which can be worked by a man and turns the wheels. When the lever is drawn back, the pawls become disengaged from the cogs of the rachet-wheels and the tractor remains stationary.

With a lever 12 m. long, the traction force at disposal is twice as great as the force exerted by the man for an average advance of 0.55 m. per stroke of the lever. When the lever is 1.50 m., 1.80 m. and 2.10 m. long, these figures are respectively: 2 ½ and 0.47 m., 3.29 and 0.33 m., 4.90 and 0.29 m. R. D.

161. **The Burmester Plough.**

BURMESTER, H. Der Garepflug. *Die Landmaschine*, Year 3, No. 83, pp. 415. Berlin, 1923.

The author describes a plough that he has invented and the manner in which it works. The object in devising the implement was to turn the slice not all at once, but in such a manner that the lower, and much the larger portion should be turned over on the furrow, while the upper part, which is composed of the dung spread on the field and of the superficial stratum that must be broken up to form the seed-bed, is turned over upon the deeper-lying slice. This insures the seed-bed being in the best chemical, physical and biological condition; further, it allows the microflora of the soil to develop rigorously, while the manure finds its way to the layer where it can become completely incorporated in the soil and be assimilated by the plants.

The BURMESTER plough is fitted with two shares, the front and upper share lifts the superficial layer of the soil on which rests the manure and carries it to one side, while the lower share cuts and turns the deeper-lying slice; then the upper layer is inverted so that the manure lies between the upper and the lower slice. The back and lower share is inserted as vertically as possible in order to turn over and break up the bottom part of the slice properly. The depth of the ploughing is regulated by the same method as that adopted in the case of deep-working SACK, or ECKERT, ploughs. F. D.

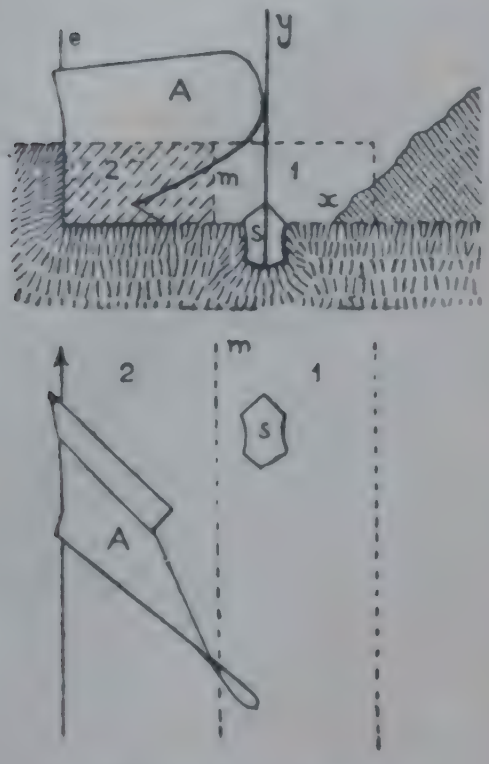
162. **Sub-Soil Ploughs.**

RINGELMANN, M. Charrues sous-soleuses. *Journal d'Agriculture Pratique*, Year 87, No. 49, pp. 454 458, figs. 5. Paris, 1923.

On any given farm, ploughing is always carried out to an almost constant maximum depth with the result that the repeated passage of tht share compresses the soil just below the layer ordinarily worked by the plough and a pan is formed that retains the rain-water. Fortunately this hard crust is not entirely continuous, but contains crevices through which the roots are able to make their way although with some difficulty.

The experiments made by the authors have proved several facts as regards this hardpan.

They passed a harrow many times over land that had already been worked uniformly and deeply. After the harrow had traversed the same tract 6 320 times, there was found, beneath the very fine, loose, superficial layer 57 mm. thick, a continuous, very compact, hard stratum 47 mm. in thickness and of a darker colour. Below this pan, at a depth of 25 cn., lay the well-worked soil broken up by the first passage of the plough-share.



Working of Sub-soil Plough.

A = Body of the plough and passage in soil.

The passage taken by the portion S is a certain distance below the layer *x* of the work piece and the projection Y, about 9-10 cm. from the vertical plane of the furrow, *m*, to avoid clogging.

The weight of the soil per cubic metre exceeded 1372 gm. in the case of the superficial layer, while in that of the hard layer, it was over 1890 gm. as the soil had settled down and the vibrations of the harrow had carried the fine particles into the crevices. In these tests, the harrow was drawn by an electrically driven arm, but the teeth could never pass mechanically into the same furrow. The trial ground was first of all broken up to a depth of 25 cm., and the hard-pan began to form after 430 passages of the harrow. It may therefore be assumed that the repeated passage of the plough will produce a similar effect in the course of time. The necessity of breaking up the layer thus formed explains the good results obtained with the subsoil plough.

Of the models recommended, preference must be given to those in which the subsoil share works at the bottom of the furrow that has just been turned and immediately in front of the body of the plough. It is well to have a flexible mounting; the working piece should be fixed to the end of a frame forming a spring. When the excavating part (subsoil share, or digging teeth) works behind the mould-board, in the furrow, the animals compress the sub-soil and tire more easily. Therefore it is best to adopt the mounting shown in the figure. R. D.

163. **The Fiorani System of Motor Plough.**

JELMONI, E. Un nuovo sistema di motoaratura. *Il Coltivatore*, Year 69, No. 27, pp. 272-274, figs. 1. Casale Monferrato, 1923.

The FIORANI motor plough is worked by a cable attached to an ordinary tractor, placed diagonally across the field. The cable is worked

PLATE XI.

New Way Harvester.

The upper figure shows the machine in action; the lower figure shows the machine depositing the heap.

on the double pulley system, unwound until the furrow is completed, as the plough moves forward. The reverse action is then started, as the corresponding engine on the tractor stationed at the other end of the field, commences to wind the cable. The horse power required is 40 to 50, for pulling the balance plough.

The author draws attention to the ease of management of this motor plough. In 8 hours, an area of more than 2.50 hectares was covered with a multiple furrow pattern and the cost (fuel, labour, etc.) amounted to about 180 *lire* per hectare.

It is proposed to encourage the wider use of this system which has already done valuable work in the improvement of certain areas.

F. D.

164. Implements for Potato Cultivation.

PASSELÈGUE, G. Machines pour la culture de la pomme de terre. *Journal d'Agriculture pratique*, Year 87, No. 44, pp. 356-358, figs. 2. Paris, 1923.

A report of tests of potato-lifters, sorters and planters held at Rémy, Oise (France).

R. D.

165. A. New Type of Harvesting Machine.

I. — *The Canadian Power Farm*, Vol. XXVIII, No. 9, pp. 12-13, figs. 4. Winnipeg, 1923.

II. — A New Way of Harvesting Flax. *Ibid.* Vol. XXVIII, No. 10, p. 12, figs. 3. Winnipeg, 1923.

I. — The "New Way Harvester", cuts and stacks the crop: it requires 10-20 HP, and employs two men. This harvester cuts a width of about 4 metres and builds stacks 2.65 m. in diameter and height; it reaps 14-18 hectares aday.

The cutting platform is practically the same as in an ordinary reaper-binder, but longer and narrower; the shape of the elevator is the same as in the latter machine, but is much higher. On one side of the elevator, there is a large cylinder into which the cut crop is placed by the elevator, and where the heap is made, when the pile reaches the top of the cylinder it comes into contact with an appliance that gives the heap a conical shape. As soon as the pile is finished, the operator releases a mechanism that raises the cylinder; at the same time, the front part slides backwards pushing the heap on to the ground. All the crop that has been cut during this operation remains on the top of the cylinder and is only allowed to fall into the cylinder when the latter has returned to its place. The author has seen the New Way Harvester working in a rye-field containing over 30 % of sow thistles, and also in a field of barley still more infested with weeds, the harvester made good well shaped stacks in the centre of which the temperature rose 2° C, the first day after harvesting, 6° C. on the fourth day, and 8°-10° C. on the sixth

day, after which it fell rapidly. In spite of the strong winds, the stacks were quite upright after a month had elapsed.

For threshing purposes, the heaps were in certain cases collected into groups. A strong rake drawn by two horses was used to displace the piles, the teeth of the rake being introduced beneath each heap. The crop is not thrown in a mass on the heap, but can easily be removed in successive layers.

The advantages of this machine are therefore: greater rapidity of work which decreases crop losses in bad weather, a saving of binding-rope, economy of labour, greater speed in threshing.

II. — The same machine has also been used in harvesting a flax field 800 metres in length. In this case, the stacks can only be made at the end of the field where they can at once be arranged in a line. The author points out that, under these circumstances, the New Way Harvester proved especially useful, since the very irregular surface of the ground would have made the mechanical removal of the crop by means of a rake a very difficult operation. R. D.

165. **Recent Improvement of Threshing Machines.**

Fortschritte im Dreschmaschinenbau und deren Auswirkungen. *Die Landmaschine*, Year 3, No. 42, pp. 513-514. Berlin, 1923.

Report of recent progress made in the improvement of threshing machines, with a view to less complicated working and at a reduced cost, lighter weight without loss of durability, and therefore less consumption of energy. F. D.

167. **New Innes Shocker.**

Farm Implement News, Vol. 44, N. 47, pp. 18-19, figs. 4. Chicago, 1923.

A description accompanied by figures of a reaper constructed by the Innes Shocker Co., Davenport.

Like other types of the same apparatus, this shocker is associated with a reaper and works alongside it. The Innes shocker has been used for 5 years in different localities with marked success. It can stook 3 acres per day as against rather more than 1 acre where hand-labour is employed. R. D.

168. **Beet Harvesters.**

Passelègue, G. (Chef de travaux à la Station d'Essais de Machines) Arracheurs de betteraves. *Journal d'Agriculture Pratique*, Year 87, No. 48, pp. 436-439, figs. 2. Paris, 1923.

The "Société des Agriculteurs du Nord" organised an exhibition of beet-harvesters which has taken place on October 30 and 31, 1923, at Phalempin (North France). The implements exhibited lifted the beets

in the ordinary manner, but were fitted with many new arrangements for insuring the topping of the beet, and also in some cases, with an apparatus for cleaning and piling up the beetroots in heaps.

The chief difficulty in removing the crown is due to the fact that beets do not always project from the soil to the same extent. In order to regulate the length of the cut, a guide-rod is used which rolls, or slides, over the leaves and exerts a certain amount of pressure ; the blade is thus always at a determined and regulated distance from the lower part of the guide-rod and the cut should therefore be regular, but the crown of leaves being more or less thick, gives unequally under the passage of the guide-rod and thus cause a lack of uniformity in the cut.

The guide-rod is generally a cylinder revolving around a perpendicular axis in the direction of the forward motion of the beet-lifter, or else it is formed of a series of four disks. of different diameters and placed facing this direction, or it may even be composed of a metal fork with curved prongs that slides along the soil, being supported and pulled by the handle.

The knife is usually a horizontal blade set at a certain angle with the axis of the machine ; in one of the models, it is a circular, horizontal cutting-disk, that rotates round its axis. The vertical distance separating the guide from the blade, can of course be regulated.

When the beets have been topped, the root-collars and leaves must be pushed on one side, so that they may not hinder the work of the lifters. This is generally done by means of a thin piece of sheet-iron shaped like the mould-board of a plough ; sometimes it is drawn out in front into a share which is the blade properly so-called. In one implement, the beet-tops are carried away by another disk with a horizontal axis parallel to the axis of the machine and having a rotary movement in the required direction. In another case, this work is executed by a revolving brush similar to that used in a sweeper.

The cleaning devices are intended to shave the roots ; sometimes they consist of forks like those belonging to a potato-planter, but at other times, the roots pass over a series of parallel shafts set closely with brushes and revolving so that the roots are pushed backwards where they fall upon a perforated disk that turns horizontally. R. D.

169. **The Brandt Stubble Burner.**

The Implement and Machinery Review, Vol. 49, No. 583, p. 789, fig. 1. London, 1923.

The Brandt Stubble burner of the Canadian Farm Implement Co. Ltd. seems to meet the requirements in British India for an implement able to burn jungle, stubble, and weeds. In the front of the chassis (see figure), there is an oil tank that fills a pressure tank by the agency of a feed-pump. The burning apparatus consists of two plates of the same width as the machine, each containing the gas-generating tubes and pipes bearing the exit holes of the flames, which are placed 15 cm. apart. The plates are kept at a height of 7.5 cm. from the ground and are mounted on pivots, so as to be unaffected by any unevenesses of the surface.

Oil is used as the combustible substance, 50 litres per hour being employed for treating 1.33 hectares. This oil is vaporised and kept at a constant pressure in the pressure tank which insures regular feeding. The mixture of air and vapour in the generating tubes produces a gas that burns fiercely and can be regulated.

This apparatus is used in Canada for cleaning fields after harvest and destroys all the stubble without leaving any flame in its wake.

R. D.

170. **A New Tree-Felling Machine.**

The Timberman, Vol. XXV, No. 2, p. 55. Portland, Oregon, U. S. A., December, 1923.

A new petrol-driven saw has been invented by a French engineer, and has been used successfully in a number of timber operations in France.

The saw itself consists of a chain with links which bear both cutting and raking teeth. These teeth point inwards and when in use the chain is linked round the tree and drawn towards the machine; the links are readily detachable. A tree 5 feet in diameter can be cut through in from 5 to 6 minutes. No difficulty has been found as regards heating or jamming of the chain in the cut. Tests have been made on hard wood filled with fragments of shrapnel, bullets etc., without damage to the chain.

The chain is driven by a 6 H. P., 2 cylinder motor, which is mounted on a two-wheeled cart, the whole weighing rather less than 3 tons.

The apparatus has been patented under the name of the "Scie-Rabot" and is manufactured by SERIN ET CIE., 11 rue de Belzunce, Paris.

W. S. G.

171. **Weed-Cutting by Boat.**

The British Farmer, vol. IV, No. 193, p. 1094, fig. 2. London, 1923.

It is almost impossible, and in any case too expensive, to free large sheets of water from weeds by hand-cutting. Messrs Saunderson (Tractor and Implement Co. Ltd. Bedford), have placed on the market two types of boat fitted at one end with a long arm to which is attached a pair of shears worked by the engine. These shears cut the weeds over a surface of 6 acres in 1 hour. The depth of the cut can be adjusted.

R. D.

172. **Note on German Cream-Separators.**

Aus der deutschen Zentrifugen-Industrie. *Die Landwirtschaft*, Year 3, No. 32, p. 403, figs. 3. Berlin, 1923.

Description of different types of cream-separators made by the Eisenwerk Brünner A. G. of Artern: type *S* with open drum, separating 40 to 60 litres of cream per hour; type *T* with plate drum, from 50 to 75 litres per hour; types *M* and *Mu* with drum having sheets or plate from 100-125 or 160 litres per hour.

F. D.

PLATE XII.

The Brandt Stubble Burner.

173. New Centrifugal Separator.

MANRIN, G. Nouveau séparateur centrifuge. *Journal d'Agriculture Pratique*, Year 87, No. 52, pp. 515-516. Paris, 1923.

M. S. HARPINSKY'S centrifugal separator consists of a cylindrical basin, or tube, 0.05 m. in diameter and 0.30 m. high. The milk to be separatted enters by the lower part of the tube, while the separation of the cream from the skimmed milk takes place at the top of the basin, where it is regulated by a screw, as in all other separators.

The high rotation speed 16 000 revolutions per minute necessitated by the small diameter of the tube, is obtained by a hydraulic turbine worked by a jet of liquid furnished by a pump ; this renders superfluous the transmission apparatus required in the case of hand-worked engines.

The driving turbine, which is of very small diameter (0.04 m.), is mounted on the axis of the tube. In some cases, the force-pump manipulates the milk the latter being sucked up into a vessel, whence it flows back into the turbine and afterwards passes into the separating bowl. The milk can, however, be allowed to pass straight into the basin, the water then being used to drive the turbine.

The following results were obtained with this separator when it was tested at the Machine Trial Station (Paris). When the milk to be separated was used as the driving liquid, and flowed back under pressures varying from 12 to 26 kg. per cm^2, the bowl made 12 000 to 16 000 revolutions a minute while 92 to 103 litres of milk passed through the machine per hour, 91 to 94.6% of the fat being removed in the cream. If water is employed as the driving liquid, with a pressure of 25 to 35 kg. per cm^2, the bowl revolves 15 000 times per minute, 106 litres of milk are treated, and a little over 94 % of the fat is recovered.

After the cream has ripened, it can be taken up by the pump and forced into a tube of small diametre in which a cylindrical piece of metal is placed only leaving a narrow ring of space round it ; the eddies and jars taking place as the cream is compressed have all the effect of churning, the operation being performed by very simple means. The agglomerated globules and the whey are evacuated from the tube, therefore all that is required in order to obtain butter is to place the product on the table to be worked up.

R. D.

Building construction.

174. Pneumatic Grain Elevators.

CRAMP, W. and PRIESTLEY, A. *The Engineer*, Vol. CXXXVII, No. 3550, pp. 34-36. London, 1924.

The authors were requested by the Department of Scientific and Industrial Research to study the question of pneumatic grain elevators, at Manchester University. In this paper they give a scientific and technical account of their work.

R. D.

175 **Buildings and Equipment for the Fruit Drying Industry** [1].

CALDWELL, S. S., Evaporation of Fruits, *U. S. Department of Agriculture Bulletin* No. 1141, pp. 1-62 figs. 18. Washington, D. 1923.

A detailed description is given of the types of artificially heated evaporators, found to be most suitable for fruit drying and of the model installations of labour saving machinery, improved methods of handling the various fruits before drying and during the actual process.

The author emphasises the importance of ascertaining whether the quantity of excess fruit is sufficient to justify the necessary expenditure. A thorough survey of the fruit areas concerned will also make it possible to determine the size and type of evaporator required to suit general purposes and all types of fruit.

Of the various forms on the market, the tunnel evaporator is considered to be the most satisfactory. This is used in the plum growing districts of Oregon, Washington and Idaho and is equally suitable for drying of peaches, apricots apples, peas, etc. The drying chamber consists of a long narrow compartment with the floor and ceiling on the same slope from end to end, with the furnace placed below the floor at the lower end. The room is cut into a series of narrow chambers, the " tunnels, " by parallel partitions extending from floor to ceiling. Warm air is admitted into each tunnel through an opening in the floor at the lower end and escapes through the ventilating shaft at the opposite end. The two ends have doors opening the full width and height. The material to be dried is spread on trays which are placed on parallel runways at the upper end of the tunnel, pushed gradually along as the drying proceeds and removed dry at the lower end. The inclination of the tunnels and the arrangement of the trays facilitates uniform flow of air throughout. The figures illustrate the general plan of this tunnel drier.

A modified form of tunnel evaporator has been developed at Oregon Agricultural Experiment Station. Its distinctive feature is an arrangement whereby the air is repeatedly re-heated and re-circulated over the fruit. This is accomplished by cutting an opening 2 ft. sq. in the floor of each tunnel at its upper end, and making a duct leading from this opening to a structure surrounding a fan, so placed in front of the furnace and piping and directed into the air inlets at the lower ends of the tunnels. Trapdoors are arranged in the walls of the furnace room and ventilators at the upper end of the tunnels. These are closed when the fan is started and the air passing through the tunnels is forced to return through the ducts to the fan, whence it passes over the furnace for re-heating and is then driven over the fruit. The fresh air inlets may then be regulated and the moist heated air allowed to escape. This should render it possible to maintain with care a constant temperature, but should not be allowed to exceed 160°F. The reduction in cost of fuel and the increased capacity of the plant are distinct advantages.

[1] For small driers see *Farmers' Bulletin* 954, Farm and Home Drying of Fruits and Vegetables. (*Ed.*)

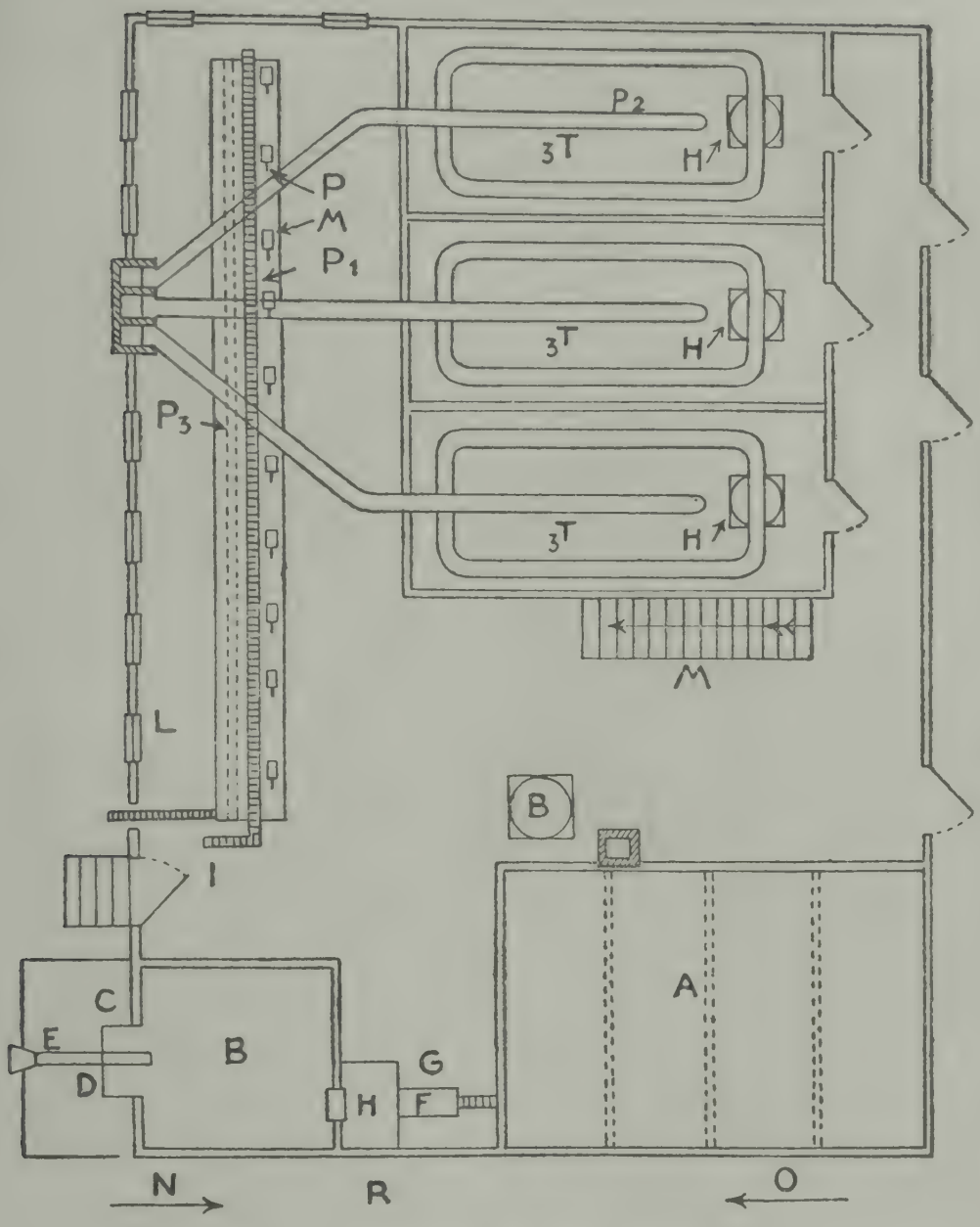


FIG. 1. — First floor plan of the tunnel drier.

A = Storage for dried fruit.
B = Bin.
B = Boiler.
C = Platform.
D = Sliding door.
E = Chute.
F = Grader.
G = Conveyer to apple bin.
H = Washing tank.
H = Heater.
I = Waste conveyer.
M P = Paring machines.
P = Pipes.
R = Ramp.
T = Tunnels.

Th author describes also the less practical kiln drying plants and apple drying equipment, followed, by details as to treatment of the various fruits previous to drying: peaches, apricots, pears, cherries, plums and bush fruits with recommendations as regards storing the dried products

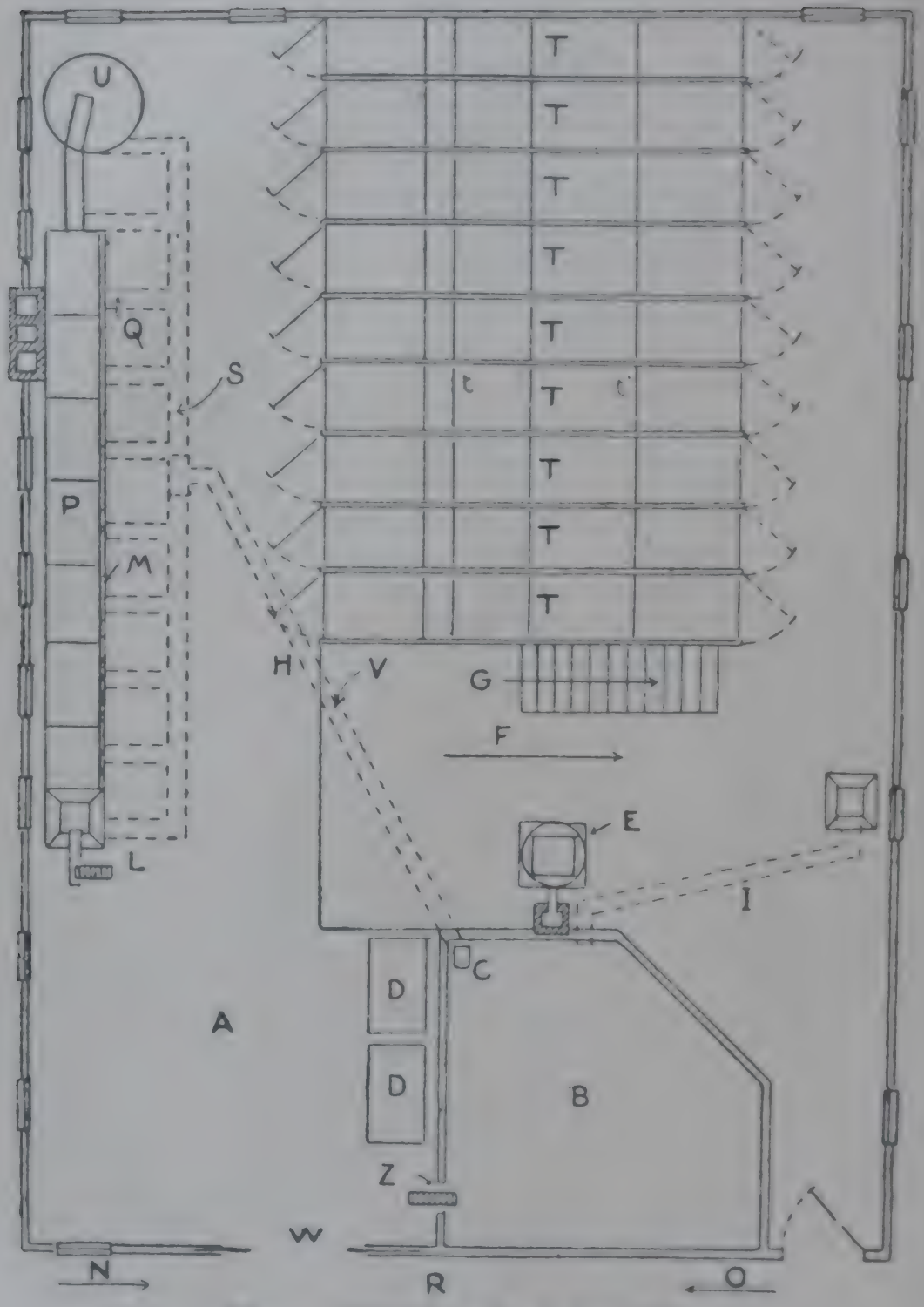


FIG. 2. — Second floor plan of tunnel drier.

A = Level floor.
B = Bin (false floor inclined to shoot).
C = Chute.
D = Trays.
E = Stove and dipping tank.
F = Sloping Floor.
G = ➤ down.
H = Chute just below floor.
N = → ➤ up.
O = ➤ ← up.
P = Bleacher.
Q = Chutes delivering to paring.
R = Ramp.
S = Table.
T = Tunnels.
V = Main chute.
W = Sliding door.

and packing. Experiments have shown that lining the boxes completely with double layers of paraffined paper, the sheets being so placed that the join of the first layer is covered by the second, greatly reduces the danger of insect infestation.

This applies to the packing of dried apple slices. Care is essential in limiting the sulphuring of peaches, apricots and pears, just before packing. Experiments made by the Bureau of Plant Industry indicate that treatment with dry steam is preferable to dipping in water. The fruit is loosely spread on trays to a depth of 2 or 3 inches, placed in a tight fitting box and the steam allowed to enter through a perforated pipe at the bottom of the box. With plums, the fruit is softened by dipping in solutions before packing — a mixture in common practice consists of glycerin 1 lb. + salt 8 oz. to 1 lb., in 30 galls. water. The fruit should remain in the solution only long enough to become heated sufficiently to make it sufficiently soft to pack. Other processes in practice are described.

The laws relating to evaporated and dried fruits in the States are given.

M. L. Y.

176. **Beef-Cattle Barns.**

SHEETS, E. W. and Kelley A. R. *U. S. Department of Agriculture, Farmers' Bulletin*, No. 1350, 16 pp., figs. 16. Washington, D. C., 1923.

Bulletin dealing with cow sheds: choice of situation, size, management, ventilation, construction, types for different kinds of animal (steers for fattening, farm cattle, breeding-stock). R. D.

177. **Dairy-Barn Construction.**

PARKS, K. E. *U. S. Department of Agriculture, Farmers' Bullettin*, No. 1342, 23 pp., figs. 15. Washington, D. C., 1923.

Bulletin dealing with the construction of cow-sheds for dairy-cattle. Situation, lighting, ventilation, and water-supply. Different types of sheds (with one floor, with two floors), cost of construction. R. D.

178. **Self Feeder for Pigs.**

Live Stock Journal, Vol. XCVIII, No 2585, pp. 373-375, figs, 7. London, 1923.

A detailed description of a trough, or rather self-feeder, for pigs. Sections and diagrams giving particulars of the construction and the measurements of the parts are also provided. The apparatus is solid, easy to make, and handle, and has special arrangements to protect it from small animals and rain. The self-feeder is easily moved and is adjustable both as regards height and width, thus its capacity is variable. G. Tg.

179. **Posts of Reinforced Concrete.**

GRUNDY H. G. Postes de cemento armado para alambrados (Posts of reinforced concrete). *El Estanciero*, Year XIV, No. 315, pp. 5-6. Tables 7. Montevideo, 1923.

The author gives a detailed description of the manufacture and advantages of reinforced concrete posts. J. P. C.

180. **Inflammability of Woods and Fabrics.**

RINGELMANN, M. Ignifugation des bois et des tissus. *Journal d'Agriculture pratique*, Year 87, No. 8, pp. 158-159. Paris, 1923.

A practical and economic solution of the problem of inflammability of woods and fabrics has for many years been the subject of investigation. Numerous formulae for solutions considered suitable for soaking highly inflammable materials have been proposed and tested. From the scientific standpoint, the question resolves itself into a determination of how to render such materials less combustible.

The substance employed : salt or a salt compound, should be used at temperature much lower than the point of ignition of the material treated. In addition the solution should be such that it will soak well into the said materials and form a surface coating acting as a protection from air.

A special Committee, established in Paris to draw up the regulations concerning inflammability of decorative wood and fencing, has also supplied important data useful in rural constructions. As a result of several experiments with a number of salts, and after taking into account divers disadvantages (cost, humidity, deterioration of textiles, alteration in colour, segregation) the committee has suggested a mixture of the more simple and effective salts and of minimum cost.

The mixture is composed of 6 kg. borax (sodium biborate), 5 kg. boric acid, 100 litres water. The fabric should be soaked for 15 minutes and then wrung out and dried. A brush or spray can then be used to cover the fabric with the wash specified. A half-litre of the mixture is considered sufficient to render 1 sq. metre of material non-flammable. After treatment, the materials no longer ignite when exposed to an electric current. There is no difference in the strength of the fabric, and when damp, the non-flammable effect is retained.

Out of 28 colours tested, only two (crimson lake and blue lake) showed any alteration. These two colours could, however, readily be replaced by others of a more durable nature.

AGRICULTURAL INDUSTRIES.

Plant Products.

181. **New Method of Estimating the Volatile Acidity of Wines.**

MESTRES ARTIGA, C. (Ingeniero-director de la Estación enológica de Villafranca del Panadés). Nuevo método de determinacion de la acidez volátil de los vinos. *El Progreso agricola y pecuario*, Year XXIX, No. 1304. pp. 465-471. Madrid 1923.

The author has devised a new method for distinguishing, in the case of wines that have been sulphured, the real acidity of the wine itself from that produced by the treatment which together with the real acidity

gives the apparent volatile acidity. MATHIEU'S method is the official method adopted in Spain for the estimation of the latter.

The new method of determining the volatile acidity which we owe to the work of Señor. S. ESTALEILA, teacher of physics and chemistry in the Institute of Tarragona, is based on the reaction between aldehydes and sulphites. Whenever these substances come into contact a new compound called aldehyde-bisulphite is formed and also an alkaline hydrate. The aldehyde-bisulphite is unstable being decomposed by acids, alkalis, and even by neutral salts. If there is any sulphurous anhydride in the wine, this passes during the successive distillations into the distillate and is transformed into sulphite reacting with the alkaline solution used in the determination of the volatile acidity ; the reaction being as follows :

$$SO_2 + 2\ Na\ OH = Na_2\ SO_3 + H_2\ O.$$

For greater clearness, we will express the titrating solution by the letter A.

Wines usually contain aldehydes that also pass into the filtrate. As long as the distillate remains acid, the sulphites and aldehydes mix without combining, but they combine, with the separation of the hydrate, as soon as the distillate has become neutral by the introduction of the solution A.

It can be proved chemically that the amount of alkalis liberated during the reaction between the sulphite and the aldehyde is half the quantity absorbed, during the titration of the distillate, by the sulphurous anhydride in its transformation into sulphite, provided there is sufficient aldehyde (which can be insured by adding a drop of formaldehyde to the distillate), so that by estimating the former, it is easy to calculate the latter.

For this estimation, all that is necessary is an acid solution of the same strength as solution A, in which case, 1 cc. of the one solution is equivalent to 1 cc. of the other.

If after the estimation of the apparent volatile acidity, 2 cc. of the acid solution are required to destroy the persistent red colour of the distillate, they would correspond to 2 cc. of the solution A, viz., to 4 cc. of the alkaline solution used to transform the sulphurous acid anhydride into the sulphite. On substracting these 4 cc. from those employed to determine the apparent volatile acidity, we get the real volatile acidity. The operation can be rendered still more striking by using an acid solution of half the strength of the alkaline solution.

The accuracy of the method has been proved by numerous tests.

The author concludes by giving a summary of Señor ESTALEILA'S method which the author himself devised and has adopted at the " Estación enológica " of Villafranca del Panadés. The technique of the operation is as follows: The distillate is titrated according to MATHIEU'S method, a note being made of the cc. of alkaline solution used. One drop of formaldehyde is then added to the distillate ; if the wine has been sulphured, the distillate assumes a deep red colour (1). Then the tritration is repeated,

(1) Sometimes the distillate turns red of its own accord owing to the presence of aldehydes but this does not alter the course of the operations. (*Author's note*)

but this time, an acid solution of the strength N/2.1 = 49 is used, and the number of cc. employed is subtracted from the number used in the first titration. From the difference the real volatile acidity is calculated in the usual way. J. P. C.

182. The Manufacture of Neutral Alcohol From Apples.

BAY, G. (Professeur à l'Ecole Nationale d'Agriculture de Rennes). La Fabrication de l'alcool neutre et à haut degré par la distillation des pommes. *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. 9, No. 37, pp. 929-933. Paris, 1923.

The law of June 30, 1916, forbids neutral alcohols made from beetroots, grain, and molasses being used for beverages in France; fruit alcohols alone may be employed for this purpose. As a result of this enactment, the manufacture of neutral, high-grade alcohol from apples has greatly increased.

The apples are washed, crushed, and placed in silos. The juice is extracted by a two-fold process; the pulp is pressed as soon as it leaves the vat after which it is moistened by the addition of 30 % of hot water and pressed a second time.

In order to start alcoholic fermentation, active dregs from a vat are used, and some of the contents of the first vat are mixed with the pomace in the remaining vats. The rapid growth of the yeast is obtained by employing shallow vats, warming the liquid by means of a steam coil (so as to obtain a temperature of 28° to 30° C), and also by the addition of nutrient salts (ammonium phosphate being usually introduced).

The distillation of the cider thus obtained is carried out in distilling and rectifying apparatus producing concentrated 95-97 % alchol. About 2 200 kg. of apples are needed to produce 1 hectolitre of pure alchol. The pomace is often dried by the waste heat from the furnaces. Nothing, however, can be done with the vinasse.

When the stock of fruit is exhausted, the distillery makes use of the more, or less, well-preserved ciders. Those that are incompletely fermented are caused to ferment again, which is a matter of some difficulty, further the product obtained is inferior to that made during the season by rapid fermentation, but its manufacture allows the distillery to continue working throughout most of the year. R. D.

183. Production of Industrial Alcohol in Cuba.

International Sugar Journal, Vol. XXVI, No. 311, p. 42, London, 1924.

The production of alcohol from molasses in Cuba as a fuel for internal combustion engines, and as a pure product is becoming an important industry. Cuba now has 37 distilleries with a capital of over $ 25 000 000, employing 3 000 men. In 1919 the output was about 23 000 000 litres, and in 1922 nearly 50 000 000, of which 18 000 000 were converted into alcohol motor fuel. W. S. G.

184. **Dried Sugar-Cane.**

CARLE (Ingénieur agronome) and HEBSCHER. (Sur l'introduction en France de la canne à sucre séchée. *Comptes Rendus des Séances de l'Académie d'Agriculture de France*, Vol. 9, No. 37, pp. 933-936. Paris, 1923.

In order to meet possible competition on the part of the sugar factories which are beginning to be started in the Colonies, the authors advise the French manufacturers of sugar in France to make some arrangement with the sugar-cane growers with a view to handling their products. In order for this to be feasible, it is necessary for the canes to reach the factories in France in a condition allowing of their being kept and treated in such a manner that no essential change takes place in their composition.

The authors have prepared, under the name of sugar-cane powder, a stable product containing a high proportion of sugar (three times as much as is present in the sugar-beet). Its composition is shown by the two following analyses :

Analysis made at the Saint Louis Refineries.

Moisture	3.45
Saccharose	60.30
Glucose	2.71
Organic matter other than sugar	3.02
Salts	0.52
Celluloses, gums	29.38
Mineral matter	0,62
	100.00

Analysis Made by the Sugar Manufacturers' Syndicate.

Water	2.68
Carbonated ash	1.68
Clerget sugar	61.93
Reducing sugars	3.00

There seems nothing to prevent this product being treated by diffusion or centrifugation in the apparatus used in beet-sugar factories

The ground cane contains nearly 30 % of cellulose, suitable for paper-making. R. D.

185. **Sugar and the Sugar Industry in Cuba.**

TILLERY, R. G. Generalizaciones sobre el azúcar en Cuba. *Agricultura y Zootecnia*, Vol. II, No. XI, pp. 375-377. Havannah, 1923.

The author gives an account of the sugar industry in Cuba, from 1535 (in which year it was introduced into Spain), until to day. He quotes figures for the crops obtained and describes the changes that have been made in the cultural and industrial methods. J. P. C.

186. **Milling Tests of Adlay (*Coix Lacryma-Jobi* var. *mayuen*) in the Philippines** (1).

I. HAYES, J. F. (Milling Investigations, Bureau of Markets and Crop Estimates U. S. Dept. of Agriculture). Experimental Milling Tests of Adlay. *The Philippine Agricultural Review*, Vol. XVI, No. 3, pp. 197-199, plates 4. Manila, 1923.

II. MARSHALL, W. K. Experimental Baking Tests of Flour made from Adlay. *Ibidem*, Vol. XVI, No. 3, pp. 201-204, plates 2. Manila, 1923.

III. DENTON, M. C. and HOFFMANN E. (Office of Home Economics, U. S. Dept. of Agriculture). Baking Qualities of Adlay Flour in Batters and Doughs other than Yeast Bread. *Ibidem*, Vol. XVI, No. 3, pp. 205-211. Manila, 1923.

IV. WESTER, P. J. Additional Notes on Adlay *Ibidem*, Vol. XVI No. 3, pp. 212-218. Manila, 1923.

I. A description of the methods employed in the milling of Adlay (*Coix Lacryma Jobi* var. *Mayuen*) for experimental milling an baking purposes, with results obtained in each case (quantity and quality of flour, percentage of shorts, etc). and suggestions concerning machinery equipment suitable for commercial ue.

II. III. — Baking tests were made with three grades of flour mixed with a certain quantity of commercial wheat flour at the office of Milling Investigations Bureau of Markets and Crop Estimates, U. S. Department of Agriculture. Preliminary tests were made to determine the most satisfactory formula to follow in mixing adlay flour, sugar, milk, salt, yeast and water preparatory to admixture with the wheat flour. According to the data the best quality bread was made with the flour mixture, $^1/_3$ durum wheat or commercial hard wheat $^2/_3$ adlay. If the order is reversed, the lower percentage of adlay flour requires more water in preparing the dough. The texture of the bread indicates that adlay cannot be substituted for wheat flour but will serve as a useful admixture. General baking tests have been conducted in connection will the Office of Home Economics and various recipes are given in detail.

IV. WESTER notes that if milling equipment is well regulated, waste, could be reduced to 50 % or more. As a result of the milling experiments effected by the Bureau of markets, various mills have been erected in the Philippines, and the author gives examples of the estimated cost of outlay. The ARCADE mill is especially recommended as a combination of simplicity and economy. M. L. Y.

187. **Soy Bean and related Fermentations.**

CHURCH, M. B. (Microbiological Laboratory, Bureau of Chemistry). *U. S. Department of Agriculture, Department Bulletin* No. 1152, pp. 1-20, tables 7, figs. 5, bibliography. Washington D. C., 1923.

The process of manufacture of soy bean sauce has been fully developed in Japan, and the Bureau of Chemistry of the U. S. Department of Agri-

(1) See *R.* 1922, No. 412. (*Ed.*)

culture has recently made a special study of the fermentation process in co-operation with Japanese expert. The authoress describes in detail the apparatus employed and the preparation for fermentation. A soy bean rich in oil and protein but with a low starch content and wheat rich in starch were used and a strain of *Aspergillus flavus* as a mold ferment. The mold-ripened beans and wheat undergo a brining process and the activity of the mold ferment and of other occasional micro-organism and yeast, continues under controlled conditions for from 6-12 months. Any form of putrefaction which may occur is due to bacterial contamination (*Bacillus mesentericus* and *B. vulgatus* groups).

The three samples obtained by pressing were analysed and judged for flavour and taste (the highest quality on the market in Japan is termed "Mogi"). Specifications as to the proportions of beans, wheat, salt and water used in grades of Japanese soy sauce are given :— best quality ratio, 100 : 100 : 90 : 180. As regards the quantity of raw fermented product and of residue obtained by the Bureau of Chemistry, with a pressure of 1250 lb., the average total filtrate amounted to 209.5 *litres* and residue to 57.3 kg.

The Chinese method of extracting soy sauce has been described by GROFF (Soy-sauce Manufacture in Kwangtung China. *Philippine Journal of Science*, Vol. 15, p. 307-1919 (1). The Chinese industry is on a smaller scale than in Japan but the sauce is of uniform quality.

Preliminary experiments indicate that peanut press cake is suitable for use in making similar sauces and has a satisfactory flavour. The mold ferments of the *Aspergillus flavus oryzae* group are used to ripen soybean food products other than soy sauce and enzymic preparations for industrial use — textile, pectin etc. It appears practicable to develop the soy sauce industry in conjunction with some already established industry. M. L. Y.

188. Methods of Preserving Seville Olives.

TORRES, A. (Ingeniero, Director de la Estación olivarera de Lucena). Conservación de las aceitunas sevillanas. *La Revista vinicola y de la Agricultura*, Year XLII, No. 20, pp. 293-294. Saragossa, 1923.

The rapid preservation of Seville olives (since the usual methods of pickling, bottling etc. cannot be adopted), is carried out by placing them in a solution (28-30° Baumé) of potash and commercial soda. In this, the olives are left to soak, the action of the lye being followed by cutting an olive through its long diameter every quarter of an hour and observing the yellowish ring that extends from the surface to the interior. The olives are then washed with plenty of water and kept in salt water (5° Baumé). Brine of 15° Baumé is used if the olives are for export, in which case, they are packed in barrels.

Small quantities of olives are preserved by being placed in a lye of wood ashes where they are left until the yellow ring has reached one third of the radius of the section of the fruit.

(1) See *R.* 1922, No. 586. (*Ed.*)

Olives may also be preserved in pure water; the process is lengthy, but the product is of superior quality. J. P. C.

189. The Paper-Making Value of the Wood of *Triplochiton scleroxylon*.

HEIM, F. (Directeur du Service d'études des productions coloniales). Valeur papetière de bois de la Côte d'Ivoire, Bois de "Samba" (*Triplochiton scleroxylon*) *Bulletin de l'Agence Générale des Colonies*, Year 15, No. 191, pp. 949-968, tables, diagram, bibliography. Paris, 1923.

During the War, a Forestry Mission was appointed to study the value of the forests of the French Colonies. Its work was not to be limited to appraising the saw timber and the wood for joinery and cabinet-making, but was to include an estimate of the paper-making qualities of the soft woods. The researches of this Mission, which were carried out in the forests on the Ivory Coast, and those of the Gaboon and of Guiana, will be treated of in future articles. The present paper gives a detailed account of the "Samba" (*Triplochiton scleroxylon*), a tree common in these regions and which supplies a pulp from which good, ordinary paper can be manufactured. R. D.

190. Straw-Rope Making.

BRASSE-BROSSARD L. (Professeur spécial d'Agriculture). Une industrie rurale, la fabrication des cordes en paille. *La Vie technique et industrielle*, Year 5, No. 57, pp. 176-177. Paris, 1923.

The author draws attention to the importance of a new industry, the manufacture of straw ropes. These ropes find a ready market in England where they are employed for packing delicate, or dangerous, goods and as insulating material in milling. The process of manufacture is described and the best straw to use (rye straw is recommended). R. D.

191. The Production of Air-Dried Peat.

Department of Scientific and Industrial Research, Report of the Fuel Research Board for the Years 1922-1923, pp. VII-146. London, 1923.

Mechanical methods of producing air-dried peat in Europe and Canada are dealt with in this report, and the difficulties entailed in the production and the possibilities of large scale projects. Investigations are described undertaken by the Fuel Research Board with reference to the preparation of air-dried machine peat in an Irish bog, employing Continental methods but on a small scale. Results confirm former observations that machine peat dries more uniformly than slane-cut peat and is superior to the latter material. A detailed and critical description is given of the peat industries in Northern Germany, Sweden and Canada.

M. L. Y.

Industries from Animal Products.

192. **Inspection of Milk Supplies.**

KELLY, E. (In charge, Market Milk Investigation) and LEETE, C. S. (Market Milk Specialist, Dairy Division, Bureau of Animal Industry). *United States Department of Agriculture. Department Circular* 276, 32 pp. Washington D. C., 1923.

An official text-book of practical instructions for the control of milk from the three standpoints: *Inspection of dairy-farms* (cows, cow-sheds, dairy utensils, storage rooms, methods of keeping and transporting the products) *and of the dairies* (buildings, water supply, drainage, lighting, machinery, utensils, methods of work, home inspection), *instruction of the Inspecting Staff* (thorough knowledge of stockbreeding, and of industrial and commercial methods connected with dairy produce, experience in testing milk, and practical knowledge of milk bacteriology and chemistry), *laboratory analysis* (equipment of laboratory, sample taking, methods of analysis, control of pasteurisation and of the almost unavoidable re-contamination taking place after this process). All the persons occupied in the different stages of the industry should be subjected to medical inspection.

The Department of Agriculture and the Official Dairy Instructors' Association have recommended two classification forms for marks which will give the different results of the inspection of thec ow-sheds and dairies. The forms are carefully drawn up and will set forth the results in question in a detailed manner. These forms have already proved a distinct success, and as soon as a minimum has been fixed by the Municipality, no dairy with marks below this minimum will be allowed to sell milk in the city markets. G. Tg.

193. **Is Fibrin a Physiological Constituent of Milk?**

HEKMA, E. Is fibrine een physiologisch melk bestanddeel? *Verslag van landbouwkundige onderzoeknigen der Rijkslandbouwproefstations*, No. XXVIII, pp. 22-46, plates, II. The Hague, 1923.

BABCOCK (Fibrin in Milk. *Report Amer. Exp. Stat. of Wisconsin*, 1889), and subsequently DOANE (Leucocytes in milk and their significance. *The Maryland Agric. Exp. Stat.*, 102, 205, 1905) expressed the opinion that fibrin is found not only in the milk of cows affected with udder disease, but also in normal milk. DOANE based his belief on the fact that after adopting DELAFIELD'S staining method for samples of the centrifuged sediment and of the cream of ordinary milk, he detected the presence of small fibres which he considered to be fibrin.

The author states that in the course of his researches on the coagulation of milk, both under the influence of rennet and of acid, fine threads greatly resembling fibrin fibres made their appearance and took part in the agglutination.

As a result of this observation, the author carried out careful experiments to decide the question whether normal milk can contain fibrin.

The different conditions under which the fibrin may be present (of which the chief are in solution and in the form of threads), were duly taken into account. Thus, the author used in this experiment, blood serum and a saturated solution of sea salt, while in the microscopic test, he stained the sample according to WEIGERT's method, and examined it in a dark field (paraboloid condenser).

The author detected no fibrin (either in solution or in threads) in normal milk ; further, he reached the conclusion that the fine threads formed during coagulation must not be regarded as consisting of fibrin, and that fibrin plays no part during the skimming of milk. These investigations have, however, shown that milk is more easily skimmed if a little blood serum is introduced, although this substance loses its effect when heated to 65°C.

The fact that normal milk contains no fibrin proves that a milk in which fibrin is found must be regarded as abnormal, therefore although it need not necessarily be unfit for use, it should be very carefully tested.

D. v. S.

194. Rapid and Certain Detection of Abnormal Milk.

VALENCIEN, C. and PANCHAUD, L. Triage rapide des laits anormaux par la Réfractométrie, la Catalisimétrie et l'essai à l'Alcool alizarine. *Le Lait*, Year 3, Nos. 7 and 8, pp. 529-535. Lyons, 1923.

The authors show how it is possible from the comparative interpretation of the data obtained from refractometry, catalasimetry and the alizarine alcohol test, to distinguish rapidly and with certainty between normal milk and abnormal, or doubtful milk. P. D.

195. Correct Method of applying Fleischmann's Formula.

PANCHARD, L. (Chimiste au laboratoire cantonal d'analyse de Genève). Un Malentendu à propos de la formule de Fleischmann. *Le Lait*, Year 3, No. 10, pp. 777-781. Lyons, 1923.

The author states that FLEISCHMANN'S formula for estimating the dry extract of milk (E) from its density (D) and its fat content (G) can only be used where G is expressed in grammes per 100 gm. of milk, in which case it gives E in gm. per 100 gm. of milk. The results of GERBER'S analyses also give the fat in gm. per 100 gm. of milk. P. D.

196. A New Use for Whey.

RIEDEL. [Vorsteher der Milchwirtschaftlichen Abtailung der Oldenburghischen Landwirtschafts-kammer]. Molkenverwertung. *Molkerei-Zeitung*, Year 32, No. 100, pp. 1841-1842. Hildesheim, 1923.

Whey is a very important by-product of all dairy industries, for in addition to the albuminoid substances and the lactose present, it also contains a certain amount of fat, a large proportion of the mineral salts of the milk (especially of phosphate of lime which is of great importance in feeding-

ing up the animal organism), and finally lactic acid, an efficient aid to digestion. It was therefore necessary to find some means of using whey in which all these substances could be turned to account.

As a result of concentrating whey to a high degree, the author succeeded in obtaining a solid stock-feed. The apparatus employed was a caldron into which the whey is thrown upon revolving wings which present a large heating surafce.

In this manner, it is possible to evaporate, at little cost, a large amount of the water present in the whey. The evaporation is facilitated by the fact that the lactose solution remains relatively fluid, even at very high concentrations. After the evaporation process is finished, the product is mixed, while still hot, with a certain amount of bran. On cooling, the lactose crystallises out of the mixture, so that the residue is fairly dry. It has, however, been found that a further drying is very advisable ; this is effected in the dry-chamber of the evaporator where the mixture can be dried thoroughly without any further expenditure of fuel.

The final product is known as " Molkenkleie " (whey-bran), it is a light-brown powder of pleasant small and a slightly sweet flavour resembling that of bread. Its percentage composition is as follows : water 12.60 — dry matter 87.34 — (crude protein 12.47 — digestible albumen 11.20 — ash 9.69 — N-free extracts (lactose, starch, fat) 60.98 — lactic acid 2.45 — crude fibre 1.75 — fat 2.04).

This feed, which is very rich, has proved excellent for pigs and they eat it with avidity. The good condition of animals given " Molkenkleie " is doubtless to be attributed to the lactic adid present, as it plays a very important part in digestion.

The experiments conducted by MÜLLER and RICHTER have, however, shown that foods given in the form of " wash " are not as well utilised as mashes. Since whey contains in its natural condition 94-95 % of water, it is evident that the above-described process should be adopted even by dairy-industries keeping a herd of pigs for fattening.

Well-dried " Molkenkleie " will keep as long as required which is a great advantage, because the largest amount of whey is available during the summer months, when owing to the age of the litters, there is least demand for pig-feeds, but owing to the fact that whey in its natural condition quickly turns sour, it cannot be preserved for the winter when it is always in great request. R. D.

197. Researches on the Adulteration of Cow's Butter.

CHARLIES, N. (Chimiste adjoint au Laboratoire Intercommunal de Bruxelles). Recherches sur la falsification du beurre de vache. *Annales de Gembloux*, Year 29, No. 10, pp. 297-311, figs. 2., diagrams 6. Brussels, 1923.

The author studies the value of a new analytic process published by PICHARD (*Annales des Falsifications et des Fraudes*), No. 175, May 1923) for detecting the adulteration of cacao butter with other fats. The process is based upon the variations of temperature in function of time that occur in the substances analysed, when they are slowly cooled down after

melting until they become completely congealed. The author applied the same method to adulterated butter made from cows milk and obtained the characteristic technical curves.

When different fats have been introduced, these curves cannot be intercalated exactly between the original curves of the constituents of the mixture for they extend beyond them or may even take quite special courses. G. Tg.

198. **The Manufacture of Camembert Cheese (1) in the United States.**

MATHESON K. J. and HALL S. A. (Dairy Division, Bureau of Animal Industry) *U. S. Department of Agriculture Bulletin*, No. 1171, 28 pp., figs. 8 Washington D. C., 1923.

The first factories of Camembert cheese in the United States were modelled on those already existing in Europe and the makers were imported from the original manufacturing centres, but the results were for the most part unsatisfactory; it proved difficult to turn out a product comparable with the French cheese at a cost low enough to allow of competition. In 1914, about one quarter of the Camembert consumed in the United States was of home manufacture, the remainder, with the exception of a few tons sent from Germany, was imported from France. About 6800 quintals of cheese, almost all Camembert, were imported from France in that year. The nearly complete suspension of importation during the years of the war was very favourable to the American industry. There are at present in the Union at least ten cheese factories where Camembert is made. Some of these factories can turn out a maximum of 54 to 158 quintals monthly. The methods of cheese-making adopted in most of the factories differ greatly from those originally introduced from France. The Bulletin under examination describes these methods and also summarises as follows the fundamental rules to be followed.

For making Camembert cheese, pure milk lately drawn from the cow and containing 3.5-3.6 % of fat should be employed. From 1 to 2 % of recently prepared active commercial starter is added to the milk; which is then left till its acidity reaches 0.20-0.22 % calculated as lactic acid; the milk is afterwards heated to 29 to 30° C. Standard commercial rennet is then added at the rate of 3 1/2 to 4 ounces per 1000 lb., or 10 to 12 cc. per 100 lb. after which the milk is left to coagulate for one hour, or an hour and a half at most, and then the curd is transferred to the moulds by means of a special ladle. If the curd has been cut before it is put into the forms, each of the forms can be inverted 4 or 5 hours later, otherwise the moulds must not be turned so soon. Each vat is filled with about 2 quarts of curd which is left to drain in a temperature of 18° C and in a relative humidity of 85-90 %.

(1) Camembert cheese was made for the first time in France by Marie Harel in 1791, at Camembert, near Argentan, in the Department of Orne. Some years later the industry received a certain importance and soon extended to the Department of Calvados. These two districts are now the chief centres of the industry in the country of origin. (Author's note).

The day after it is made, the cheese is salted and removed to the ripening room.

The cheese is inoculated with a culture of *Penicillium camemberti*, or else this mould is mixed with salt and spread over the cheese just before it is placed in the ripening room. The temperature of the room is kept at 11-12°C and its relative humidity at 85-90 % according to the conditions of ripening and ventilation. The cheese is ready to be put up in paper as soon as the mould has thoroughly established itself and the moisture content reaches 50 to 54 %, which takes two or three weeks according to the ripening conditions and the method of manufacture. Each cheese is wrapped up in a thin sheet of tin or aluminium foil to which is attached parchment paper, or else it is wrapped in this paper alone. The cheeses are placed in boxes containing half a pound and the boxes are packed in crates holding five dozen each.

About 200 cheeses per 1000 lb. of milk should be made from milk containing 3.5-3.6 % of fat.

Not taking into account the losses due to handling, it is estimated that the industrial manufacture of a cheese costs 18.41 cents (American), the price of the milk being 10.25 cents and the cost of labour amounting to 1.97 cents.

The wholesale price varies from 3.25-3.50 dollars per dozen ; the retail price is 35-50 cents each.

Camembert is chiefly made in the autumn, winter and spring. The cheese is in most request during January and February. F. D.

199. **Rapid Method of Manufacture of Cheddar Cheese.**

MOURAD, J. H. Procedimiento abreviado de fabricación del queso Cheddar. *El Campo*, Year 5, No. 85, pp. 51-55 figs. 15. Buenos Ayres, 1923.

A detailed description of the present methods of manufacture of Cheddar cheese and of an improved and far more rapid system employed by the authors.

This new method consiste in scalding the curd and instead of clearing off the whey, the vat is covered over for 30 to 40 minutes, and uncovered only when the curd has consolidated entirely ; after turning, and stirring, the cheese is covered and left to ripen, and the taste tested when ripened, the whey is collected and stirring continued without interruption, followed by salting and refrgeration to avoid thickening.

Instead of using a cloth, a double covering is used, so that one thickness will adhere to the cheese, thus acting as a protection from flies.

The system of keeping the curd in whey, stirring from time to time to prevent thickening avoids the necessity of slicing after consolidation. Acidity develops more rapidly in the curd, when covered by a layer of whey, ripening is more speedy and the cheese can be turned out readily on to the press. Care must be taken, however, to avoid excess of acid, liable to result in a very dry cheese without aroma ; the natural consequences of early removal of whey suggests the advisability of taking a small portion and placing on a hot grate and then stretching into an elongated form 2-3 cm. J. P. C.

200. **Estimating the Amount of Salt in Cheese.**

VAN DER BURG, B. (Prof. de Laiterie à Wageningen). Dosage du sel marin dans le fromage. *Le Lait*, Year 3, No. 9, pp. 600-602. Lyons, 1923.

Salt plays a very important part in cheese, for not only has it a direct effect on the flavour, but owing to the different degrees of susceptibility to salt shown by the micro-organisms present in freshly-made cheese this substance exercises a distinctly selective action upon them thus influencing the ripening process.

The degree of the salt concentration affects the swelling of the paracasein, which in its turn, influences the plasticity of the curd. From many observations, it would appear that the optimum concentration varies around 5 %. Since the action of salt is so varied and important, it is clearly advisable to find a more rapid and less troublesome method than ash determination for estimating the amount present in cheeses that have been salted by soaking them in brine or by sprinkling them with salt.

The author suggests the following process. The sample of cheese is ground to powder and carefully mixed, then 3.9 gm. are introduced into a ball of 100 c.c., 50 to 60 c.c. of hot water and 10 c.c. normal caustic soda being added. The whole mixture is then stirred until the cheese is dissolved. It is then left to cool, after which 10 c.c. of nitric acid are added and distilled water to make up 100 c.c. The mixture is filtered through a dry filter, and 50 c.c. of the filtrate are treated with a deci-normal solution of nitrate of silver. The excess silver nitrate is estimated by means of a decinormal solution of sulpho-cyanide of potassium, after adding 1 c.c. of a saturated solution of iron alum and without the removal of the chloride of iron that has been formed. The percentage of salt is found by multiplying the number of c.c. of the silver nitrate solution by 0.3. The author shows that by means of his process a sufficient degree of accuracy can be obtained as compared with exact data furnished by the ash method. P. D.

201. **Frigoraseptic Method of Keeping Fresh Meat.**

BONNAFOUX. Conservation de la viande à l'état frais par la frigorasepsie. *La Revue Générale du Froid et des Industries frigorifiques*. Year 4, No. 12, p. 429. Paris, 1924.

Frigorisepsis combines chilling with antiseptic treatment; its object is to enable chilled meat to be conserved longer, and to retain all the nutritive and organoleptic properties of fresh meat. The process consists of three parts: 1) superficial antiseptic treatment; 2) rapid cooling; 3) removal of the antiseptic used.

The two first operations are performed simultaneously, the antiseptic being removed by a current of dry air. The three operations take about 12 hours and are all carried out under normal pressure. The loss of weight amounts to 2 ½ to 3 %. A cold chamber kept at about 4° C above zero serves as a store-house.

The chief advantages of this new system are: 1) Substituting chilling

for freezing and a consequent saving of 50 % of the freezing power ; 2) a considerable lengthening of the time during which the meat is conserved in the fresh air after leaving the chilling chamber ; 3) although the temperature advised ranges from 0-4° C., the meat can be kept, without any alteration, at 8-12° C. for a month which renders it possible to use cheap cars, and even cars that have not been specially arranged for the purpose. 4) all the existing cold storage plant can be utilised.

Meat thus preserved has been declared by the Sanitary Service to be in perfect condition and fit for human consumption. R. D.

202. **Factory for Ham and Pork-Butchers' Products.**

L'usine de la Société « Aux Jambons Français " at Pré-Saint-Gervais (Seine). *Le Génie Civil*, Year 43, No. 22, pp. 529-534, figs. 10, plate 1. Paris, 1923.

This article describes the organisation and equipment of a new factory opened near Paris for curing hams and the preparation of pork-butcher s products. Salted pork, Alsatian specialities (smoked and cooked), French specialities (only cooked), and dried sausages. R. D.

203. **Correlation between White, Yolk and Shell of the Eggs of Various Birds.**

FRIESE, W. (Landesstelle für offentliche Gesundheitspflege zu Dresden). Über die Gewichtsverhältnisse von Eiweiss, Dotter und Schale einiger Vogeleierarten. *Zeitschrift für Untersuchung der Nahrungs– und Genussmittel*, Vol. 46, No. 1, pp. 33-37, tables 12. Berlin, 1923.

Report of observations made by the author giving in tabular form the total and absolute weight and proportions of the various parts of the eggs of hens, geese, ducks, turkeys, pigeons, guinea fowl, pheasants, gulls, lapwings, blackbirds, sparrows, canaries. The following data is given with reference to domestic birds.

	Hens	Geese	Ducks	Turkeys	Pigeons	Guinea Fowl	Pheasants
	%	%	%	%	%	%	%
Whites	56.22	52.23	50.03	56.72	72.35	44.02	52.79
Yolks	31.72	32.72	38.02	32.51	18.05	39.3	37.33
Shell	12.06	14.05	11.95	10.77	9.60	16.60	9.88
Total weight . .	57.12 gm.	137.38 gm.	78.11 gm.	92.93 gm.	21.88 gm.	41.14 gm.	27.03 gm.

F. D.

PLANT DISEASES (1).

Diseases not due to Parasites or of unknown origin.

294. **Law for the Protection of Agriculture and Forests Against Smoke Injury in Austria.**

Communication by Dr HERMANN KALLBRUNNER, Vienna.

No impartial observer can fail to note the considerable increase in injuries of all kinds produced by the action of smoke upon buildings, metal objects, and especially plants, in Austria.

The deleterious effect of smoke upon man and animals is no less marked, particularly in certain districts.

The causes of the smoke nuisance are of different kinds, but certainly the growing industrialisation of the country which is most satisfactory from the economic standpoint, is to a certain extent responsible for this trouble, although it is mainly attributable to the greater use of the native, inferior type of coal with high ash content and relatively large percentage of sulphur that Austria is obliged to burn, now that she is cut off from her natural sources of well-mineralised coal, in order to avoid burdening her budget with any unnecessary expenses.

Further, during the War, many chimneys and heating plants were carelessly constructed, or enlarged, without proper measures being adopted to prevent excessive injury due to smoke, while as a result of military exigencies a considerable change took place in the kind of stokers employed, so that the old experienced hands have often been replaced by men who are new to the work. Lastly, during and after the war, factories for the utilisation of the mineral wealth of the country were erected in districts that before had been free from smoke injury.

Speaking solely of the damage caused to agriculture and to forestry, we may say that in dry years especially (the last 3 years were exceptionally dry), smoke has been found to injure leaves and fruits; it also has the effect of greatly reducing the crops (according to STOKLASA, the sugar-beet harvest fell in one case 15, and in another, 22 metzentners per hectare), while the development of domestic animals was conspicuously retarded, even when they escaped severe illness, but where the forage was thickly covered with dust, serious cases of gastric and intestinal catarrh were the rule among the live-stock.

The agriculturists have, in the majority of instances, attempted to take measures for protecting themselves against the losses caused by smoke injury, but their efforts have met usually with little success, and have only resulted in claims for damages and law-suits that have cost the plaintiffs time and money and afforded them very little compensa-

(1) See also Nos. 12, 25, 32, 34, 40, 45, 46, 59, 63, 63, 71, 73, 88, 102, 108, of this *Review*. (*Ed.*)

PLATE XIII.

SMOKE INJURY TO PLANTS.

Section of forest in Ebenfurth (Wiener-Neustadt), photographs taken the same day.

FIG. 1. — Undamaged portion.

FIG. 2. — Damaged portion.

tion. FORSTRAT VODITSCHKA gave an excellent account in the « Wiener Landwirtschaftlichen Zeitung » dated November 17, 1920, of different law-suits brought for the purpose of obtaining compensation for smoke-injury in the Salzburg district. The claims referred to damages to fir-trees (in Kasern); to fruit-trees, arable-land, pastures, woodlands and cattle (in Sulzau); to houses, bees, fruit-trees, fields, woods and cattle (in Mitterberghuttens, and Lend). In one case, when all the evidence had been heard, judgment was given in favour of the landowner, and the smelting-works had to pay all the costs of the suit. In other cases, after a long law-suit, a compromise was arrived at, the owner of the works agreeing to pay the costs of the litigation provided the plaintiffs withdrew their protest.

In other instances, the compensation claims were amicably settled. One factory became bankrupt while the suit was in progress, so that the agriculturist obtained no redress. Opinions and analyses were sought from many different places which entailed very heavy expenses quite out of proportion, to the damage done and the amount of compensation claimed.

To this cumbersome procedure, coupled with the above-mentioned increase in smoke injury, may be attributed the growing wish that as comprehensive a law as possible should be framed in order to prevent smoke damage generally, if this is feasible, and in any event, to provide adequate compensation for all losses entailed by it.

The movement started in Steiermark which suffers most from the smoke nuisance since the factories belching out these fumes are not infrequently situated in narrow valleys whose rocky walls prevent the escape of the smoke.

Now, however, that the importance of the matter is realised, an attempt is being made to render the law more effective by extending its provisions to the whole Austrian Republic.

The novelty of the question, which, although it has frequently been discussed in international agricultural congresses has never been the subject of legislation with a view to protecting agricultural crops from injury, warrants our giving a brief summary of the chief points of the Bill (1).

The Health Ministry is interested in the regulation of both the smoke and the dust nuisances.

Smoke-Injury, in the terms of the Bill, includes all damage inflicted upon agriculture and forestry by the smoke, dust and gas production of industrial or railway plants. (Only a few provisions deal with the compensation of injury due to railways).

Whenever it is a question of the construction, renovation, or enlargement of factory or commercial premises likely to cause injury

(1) A very interesting and exhaustive account of the legislative measure adopted, in the several States for protection against injuries from smoke is to be found in STOKLASA'S work entitled " Die Beschädigungen der Vegetation durch Rauchgase und Fabriksexhalationen. " There is however, no law dealing with the subject from the agricultural standpoint.

from smoke, every effort shall be made to prevent or minimise such injury. The Trade Officials are empowered to insist upon alterations being made in the plans, and to oblige owners of the premises to make and maintain any arrangements required for the protection of crops. At the request of the owner of the farm affected the trade-officials acting on the advice of sworn smoke-injury experts shall proceed to the examination of the sources of the smoke and order protective measures to be adopted and maintained.

Owners of property which produces smoke are held responsible for any unavoidable injury done by the said smoke to agriculture, or forestry, and this without prejudice to their liabilities incurred under other laws; they are required, if the smoke injury can be lessened by a change in the cultural operations, to defray any additional expenses that may thereby be entailed. The landowners are obliged to carry out these operations, but they can demand compensation both for the actual injury due to these changes, and for the loss of the produce they would have obtained under the original conditions had there been no injury caused by the smoke. If in spite of all alterations in the management, certain properties or farms cannot be made to pay owing to severe smoke injury, the owner of the source of this nuisance is obliged to make good all loss entailed, or else to purchase the deteriorated land, or premises. His obligation must be decided by an expert on smoke damage and the liabilities assessed by an arbitration Board appointed for dealing with matters relating to smoke injury. (The case may only be taken into the ordinary courts when the conciliatory efforts of the Board have proved fruitless).

This arbitration Court for dealing with smoke injury claims is appointed by the Government. On the request of the owners of the premises inculpated, and of the landowner, it shall decide whether any just cause of complaint exists, in which case it must try to effect a compromise without referring the matter to the law courts. In every instance the damaged property must be exactly described, and a detailed account given of the means adopted to lessen the smoke injury as well as of the changes in farming operations necessitated and the actual injury caused by the smoke.

Every landowner has the right to demand the institution of a legal enquiry when the remedies applied have proved to some extent, or wholly, ineffective.

Compensation for smoke injuries must be paid annually in gold, or in some substitute for gold. Indemnities that have once been assessed can only be remitted when all chance of damage is completely removed. The assessment of claims must never be made in advance, for the injuries inflicted vary greatly each year according to the prevailing winds, the rainfall, the amount of work done at the factory, etc.

If there has already been an increase in the damage occasioned (but the experts and Board of Arbitration see no occasion to suppose that further increases will be of annual occurrence) the indemnity is generally raised only at intervals of five years. With due regard to the possible

intervention of new factors, this additional compensation is however to be reckoned on the basis of the first rise in the indemnity and paid to the landowner by the possessor of the source of the smoke nuisance when the account is finally settled between them.

The arbitration Board, which is appointed for 3 years, must be composed of :

(1) A judge acting as chairman (nominated by the President of the " Oberlandesgerichtes ") ;

(2) and (3) a representative of industry and agriculture (nominated by the Chamber of Commerce and Trade or by an accredited member of the agricultural industry).

(4) One official of the Technical Industrial Service (appointed by the Government).

(5) One Official of the Agricultural or Forestry Service (appointed by the Government ; according to the nature of the case). One expert is nominated for each member.

After all the necessary information has been obtained, the Arbitration Board suggests a compromise that at once becomes binding if both parties have signified their willingness to abide by the arbitrators' decision. In default of such a declaration, the parties in question must inform the Board in writing, within 14 days from the time judgment has been delivered, whether they intend to accept or reject its findings. In the latter event, or if no declaration is made, the matter can be referred to the ordinary court of justice. The arbitrators' award also decides which side shall defray the cost of the proceedings and the expenses of the experts. In cases of undoubted injury due to smoke, these costs are paid by the owner of the source of the nuisance. The further details are settled by a standing order from the arbitration Board and notified by the Government.

Only sworn smoke-injury experts may take part in these negociations. Their names are entered on a list kept by the authorities which is easily consulted. To obtain recognition in this capacity, it is necessary to have had many years of practical experience, and usually the candidate is required to have attained the High-School standard of knowledge of the sciences involved. Before recognising and swearing in the expert, the Government authorities are obliged to be satisfied as to his fitness for the task and must ascertain whether he is acceptable to the representantives of industry and agriculture.

It is to be assumed that by the application of the law under discussion it will be possible in a large number of instances to settle the serious, costly and deplorable differences between Industry and Agriculture in a manner satisfactory to the economic interests common of both sides, and that in any case, it will effect an improvement in the present condition of affairs.

This law has been framed with a view to provide against the petty difficulties and the unjustifiable trickery that now unnecessarily embitter the relations between industry and agriculture. It will also be necessary to exclude all possibility of profiteering and the exploiting of the owner of the source of the smoke injury.

STOKLASA, who estimates the annual loss attributable to smoke injury

in Czecho-Slovakia at 250 to 300 million Czeco-Slovakian crowns (the damage in Austria is certainly less, but is much more felt owing to the great poverty of that country), says at the end of his book: " Educational measures are more effective than legal measures, and again: Certainly legal measures will be necessary everywhere, but there is no hope of their being carried out properly until the manufacturers have learnt that it is in their own interest to support the officials in combating smoke-production ". This is indeed the most correct view of the matter. The agriculturist must not depend upon the larger or smaller amount of compensation awarded him. His business is production and he should receive every protection in the exercise of this duty.

Technical science is now so highly developed that it is undoubtedly in a position to devise methods for protecting, without detriment to industrial interests, not only agricultural production, but also the health of its own workers.

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WÖBER. Versuche über künstliche Rauchschäden mit schwefeliger Säure im Jahre 1914. Bericht der Bundesanstalt für Pflanzenschutz im Jahre 1919. *Zeitschrift für das landwirtschaftliche Versuchswesen in Deutschösterreich*, Vienna, 1919, p. 169.

205. Mosaic-Immune Variety of Sugar Cane.

VILLAMIN, V. *Sugar*, Vol. 25, No. 7, p. 345. New York, 1923.

A variety of cane found to be immune to mosaic disease was discovered in March, 1920 by Sr. ROBERTO TOLEDO of Pampanga, Island of Luzón (Philippines). Dr. E. W. BRANDES, of the United States Depart-

ment of Agriculture, has confirmed the discovery and is conducting further tests. The six stools cut for seed in December 1920 have now produced about 7 acres of cane.

The ratoon stalks rarely exceed 1 ¼ inches in diameter, the leaves are narrow, the rind is tough, purple in colour and the pith yellowish.

The juice analyses of cane cut in February 1923 from the plant at age 15 months, gave the following results:— Brix 19.6, sucrose 17.17, purity 87.60. W. S. G.

Plant parasites.

206. **Wart Disease of Potatoes.**

The Scottish Journal of Agriculture, Vol. VII, No. 1, pp. 72-82. Edinburgh, 1924.

Although Great Britain is the country where wart disease of the potato (*Synchytrium endobioticum* = *Chrysophlyctis endobiotica*) (1) is most common, there is still some danger of the crops being further infected by potatoes imported from abroad.

Therefore this article, which gives a brief account of the origin and history of wart disease, was written with the object of informing agriculturists of its present distribution in the world (a map is given showing the distribution of the pest within the United Kingdom), as well as in order to acquaint them with the means of control and the legislative measures adopted by the different countries with a view to checking the spread of the disease.

A bibliography is appended to the article. G. T.

207. ***Phytophthora mexicana*, n. sp. a Peronospora Injurious to the Tomato in Mexico.**

HOTSON, J. W. and HARTGE, L. A Disease of Tomatoes Caused by *Phytophthora mexicana* sp. nov. *Phytopathology*, Vol. 13, No. 12, pp. 520-531, figs. 2. Lancaster, Pa., 1923.

To the four species of *Phytophthora* hitherto reported as injurious to the tomato there must now be added another that the authors have kept under observation and cultivated for over three years. The fungus in question was isolated from tomatoes that had been sent from Seattle (State of Washington) to Mexico in the summer of 1917 and were kept alive until 1920, when the cultural experiments were begun which furnished the minute details reported by the authors respecting the mycelium, conidiospores, conidia, clamydospores and oospores of the fungus.

This peronospora, when inoculated into young, or old, tomato plants, produced the characteristic wilting, accompanied by a blackening of all the parts situated above the point of inoculation. After two days, there appeared on the fruit all round the place of inoculation, a watery area

(1) See *R.* 1923, No 311. (*Ed.*)

which in the course of a week, developed into a rot that destroyed the entire fruit.

Since the fungus did not seem to belong to any of the known species of *Phytophthora*, the author described it as a species new to science giving it the name of *Phyt. mexicana*. G. T.

208. **The Diseases of the Tea Bush.**

PETCH, T. (Mycologist to the Government of Ceylon). XII + 220 pp., 3 col. pl., 69 text-figures. London, Macmillan and Co., 1923.

This work is intended for the use of planters, to enable them to recognise diseases of the tea bush and to take the necessary steps for their control. Sixty diseases are described, several of which are new in that they have not previously been discussed in a comprehensive survey. W. S. G.

209. **Blister Rust of *Pinus Strobus* (*Cronartium ribicola*) in Michigan (United States).**

BAXTER, D. V. and COONS, G. H. White Pine Blister Rust in Michigan. *Michigan Quarterly Bulletin*, Vol. 5, No. 4, pp. 193-196, fig. 1. East Lansing, Michigan, 1923.

White pine blister rust (*Cronartium ribicola*), was discovered in Michigan, during 1917, in a nursery garden in the County of Oakland, where it attacked and destroyed some imported individuals of *Pinus Strobus*.

In 1922, the disease was observed in different localities of Michigan, all of which were in the County of Oakland, with the exception of one which was in the County of Kent. Not only white pines coming from France were attacked, but also cultivated and wild specimens of *Ribes* spp. On this occasion also all the infected plants were killed, but since it is possible that centres of infection may exist, the greatest vigilance is necessary. G. T.

Weeds and Parasitic Flowering Plants.

210. **Weed Destruction.**

I. SCHRIBAUX. Comment arriver à detruire par voie chimique et biologique les organes souterrains et les graines de mauvaise herbes. *Comptes Rendus des séances de l'Académie d'Agriculture de France*, Vol. IX, No. 38, pp. 941-946. Paris, 1923.

II. LOYER. Emploi des chlorates pour la destruction des herbes dans les céréales de printemps. *Ibidem*, pp. 957-960.

III. Le sel contre les mauvaises herbes. *Vie à la Campagne*, Vol. XXI, No. 248, p. 65. Paris, 1924.

I) M. SCHRIBAUX is of opinion that more efficient chemical methods of destroying weeds could be devised than those at present adopted, and further, that the appointment of a special service for weed destruction is very

necessary. Not only the chlorates, of which mention will be made later, merit study, but also the perchlorates that prove most active.

Caustic chemical substances can be used in combating young plants whose tissues have not yet lignified. It is not, however, enough to destroy the aerial portions as long as there are underground organs capable of throwing up new stems. Toxic substances must be employed which, after finding their way into the cell-sap through the open wound produced by cutting off the aerial part of the plant, are able to penetrate into the smallest rootlets.

The real remedy consists in destroying the weed seeds in the soil. The author does not believe in the possibility of destroying *hard seeds* (encased in an impermeable integument through which solutions cannot pass), by means of chemical substances, even if strong solutions are employed, unless a way is prepared for them by bacteria that attack the cellulose.

Toxic substances would prove effective in the case of mustard and wild radish seed, or any other seeds with permeable integuments. They could be applied as a dressing to land left fallow before seeding for long enough to allow of the poison being transported to the weed seeds and washed down, as soon as its work was accomplished, into the lower strata where it would be out of the way of the crop. The best types of compound to use are those that like sulphocyanide act first as a poison and subsequently become transformed into a fertiliser which, in the case of sulphocyanide, is ammonium sulphate.

II) Weak solutions of chlorates are used for killing the weeds in crops of spring cereals ; they are quite as efficient as the metal salts and have the additional advantages of being easily kept and of travelling either in the solid form, or in an aqueous solution in tins ; further, they do not burn and are innocuous both to man and animals.

The ammoniacal salt is the best chlorate to use, although a mixture of chlorate and nitrate of sodium may also be employed. Ammonium chlorate should be applied at the rate of 7 to 8 kg. per hectare for weed-killing. The amount can be increased up to 25 kg. without injuring the cereals, provided it is used in April, May or the beginning of June, when the crop is at the height of its growth.

On the other hand, 2 % chlorate of sodium applied at the rate of 250 kg. per hectare has been found by M. RABATÉ to destroy all plants in paths, in courtyards, etc.

Experiments were conducted on a large scale in 1922 and 1923, about 200 hectares under cereals being entirely freed from weeds. One of the fields was planted with oats and divided into 4 plots (the first serving as a control). The treatment was carried out on June 9, 19123. The second plot received a sulphuric acid solution, 4½ litres, or 8 kg. of acid (64° B.) being mixed with 100 litres of water ; the third plot was treated with a solution of copper nitrate (2 kg. copper nitrate in 100 litres of water), and the fourth with ammonium chlorate (1 kg. in 100 litres of water). The three plots taken together were sprayed with 800 litres of solution per hectare, this amount corresponding to 64 kg. sulphuric acid, 16 kg. copper nitrate, 8 kg. of ammonium chlorate.

One hour after the sulphuric acid treatment, the weeds were seen to bend over. Small white patches appeared on the weeds an hour after the chlorate was applied, but the oats remined unaffected. The sulphuric acid, however, had no effect until six hours later, when its action was very marked; the nitrate of copper acted still more slowly. In the plot treated with the chlorate, the leaves of the weeds were folded over on themselves, but the oats were little affected.

The differences between the three plots decreased as time went on. On June 16, the weeds had disappeared from all of them; the oats were erect, though the tips of their leaves were spotted with white by the action of the sulphuric acid, or with rust-yellow, or greenish-yellow by the nitrate and chlorate respectively. At harvest time, in all three cases, the weeds had disappeared and the oats were a splendid crop. The chlorate possesses the advantage of being easily applied in very weak doses, while even if the solution is 5 or 6 times stronger than is necessary, it produces no ill effects upon the crops that follow.

III) M. Key (Professeur d'Agriculture, Doubs, France) made an experiment in April 1923 with the object of testing the destructive effect upon weeds of large quantities of denaturated salt. Crystalline salt used as a dressing only gave good results when large amounts were used (700 to 1000 kg. per hectare), which entailed too great expense. Sprays of salt solution, on the other hand, have proved very useful; a 20 % (per weight) solution killed 80-89 % of the most troublesome weeds without doing any injury to the oat crop. The treatment only cost 60 fr. per hectare (400 kg. of denaturated salt at 18 francs, per 100 kg. and 6 francs for labour).

The spraying was carried out at the end of winter, or the beginning of spring; the results obtained were as follows: 1) the wild radish and charlock were completely destroyed, 2) the aerial parts of the chenopods, knotgrass, bindweed, chickweed, corn-poppies, vetches, clovers, ranunculi and chicory were entirely scorched. R. D.

Animal parasites.

211. The "Argentine Ant" (*Iridomyrmex humilis*) in Algeria.

Inspection de la Défense des Cultures. La Fourmi d'Argentine en Algérie. *Bulletin Agricole de l'Algérie-Tunisie-Maroc.* Series 2, Year 29, No. 11, pp. 210-211. Algiers, 1923.

Some members of the Staff of the "Service de la défense des Cultures", which has its headquarters at Algiers, have recently discovered numerous individuals of the Argentine Ant (*Iridomyrmex humilis*) in consignments of fruit.

The serious consequences that might arise from a possible invasion of Algeria by this insect are described in this paper as are also the best means of preventing the ant from penetrating into the Colony and establishing itself there. G. T.

212. "Olive Fruit-fly" (*Dacus oleae*) in India.

Communicated by Mr. T. BAINBRIGGE FLETCHER, Imperial Entomologist at the Agricultural Research Institute at Pusa, and transmitted R. B. EWBANK, Esq., I. C. S., Deputy Secretary to the Government of India.

So far as we are concerned in India, there is nothing new to record on the "olive fruit-fly" (*Dacus oleae*). At Professor Silvestris' request I examined wild olives in the North-West Frontier Province in 1916 and found the "olive fruit-fly" in them at Cherat but was unable to find it (although this of course does not prove its non-occurrence) in the Kurram Valley.

We know therefore that this fly occurs in India and we know also that it has a natural parasite (*Opius ponerophagus*, Silv.). These facts will doubtless be of interest in the future should olives be cultivated on a more extended scale. The Peshawar experiments have shown that the European olive will do very well in India and there are many tracts in the N.W.F.P., Kashmir and Kumaon which appear to be very suitable for this tree.

The small olive orchard at Peshawar has so far escaped attack by the "olive fruit-fly", doubtless because it is rather isolated from the more hilly districts in which the wild olives grow, but with extended planting of the cultivated trees they will doubtless be attacked and the "olive fruit-fly" will then become an important factor in the situation.

213. Control of Olive Fly (*Dacus oleae*) and of *Icerya purchasi* in Catalonia (Spain).

Lucha biológica contra los parásitos de las plantas. *Revista del Instituto Agrícola Catalán de San Isidro*. Year LXXII, Pt. II, p. 226. Barcelona, 1923.

The "Servicio de árboles frutales" of the Department of Agriculture "Mancomunidad", Catalonia (Spain) has organised an expedition in Tripolitania with the object of collecting specimens of the hymenopteron Braconidae *Opius concolor*, an endophagous parasite living on the olive fly (*Dacus oleae*) and to adapt the insect to the climatic conditions of Catalonia where the most damage is caused by the Dipteron. Some 8220 specimens have recently been sent to Ulldecona, a district which suffers seriously from this pest.

In addition, samples of the Coccid *Novius cardinalis* have been collected for the control of *Icerya purchasi*, parasitic on several cultivated plants in Catalonia.

G. T.

214. Cold Storage as a Control of Fruit Fly. (1)

GURNEY, W. B. *The Agricultural Gazette of New South Wales*, Vol. XXXVI. Pt. 7, p. 528. Sydney, 1923.

During last summer a series of experiments with fruits attacked by fruit fly, were made with the object of noting if a period of 20 days in cold storage at a temperature of 34°F was sufficient to destroy the insect. Results were encouraging and indicated clearly that after being treated thus, fruits destined for local consumption can be taken out of cold storage and the frnit found in good condition finds a ready sale. Fruit intended for export and held in cold storage before shipping, can be introduced into another country or locality without any danger of importing the fruit fly.

Six small lots of infected fruit were tested : oranges, apples, peaches, nectarines and pears. In January and February, 1923, these were placed in cold storage at a temperature 1.1° C. and kept there for twenty days with the exception of one portion which was retained for twenty-three days. After removal from cold storage, the fruits were transferred to a jar, where they were kept under observation, and if any flies had still been alive they could have hatched. After three months, no fly was observed, although the contrary was noted for the control tests.

Further experiments will be made to ascertain whether temperatures varying from 38°F to 40°F are equally effective in destroying this parasite, and also the possibility of varying the length of cold storage.

G. T.

215 *Protoparce* (*Phlegethontius*) *sexta* var. *paphus*, a Macrolepidopteron Injurions to Tobacco, in Uruguay.

TRUJILLO PELUFFO A. Enemigos del tabaco. Repùbblica Oriental del Uruguay, Ministerio de Industria, Defensa, Agricola, *Boletin mensual*, Year IV Nos. 11-18, pp. 125-130, figs. 6. Montevideo, 1923.

Protoparce sexta (Joh.) var. *paphus* (Cram) is the most formidable of the various enemies of the tobacco plant in Uruguay.

A short morphological and biological description is here given of this macrolepidopteron (fam. *Sphingidae*) which is popularly known as " gusano verde ", or " gusano del onerno." It is estimated that the life-cycle of the insect lasts from forty-two fo forty-four days, the larval stage lasts twenty to twenty-one days, and the chrysalis stage about twenty-one to twenty-three days. There are two generations of this pest in Uruguay, the first appearing in December and the second in February. The insect passes the winter as a chrysalis ; it remains underground, burying itself in March, or at the beginning of April.

(1) (The name fruit fly has also been given to the Diptera, of the fam. *Trypanacidae*, (= *Trypetidae*) the larvae of which are frequently found in the fruits of several peanuts. In the present case, the species is probably. *Batrocera* (*Dacus*) *tryoni*. (*Ed.*)

The larvae live entirely on the tobacco leaves ; their voracity increases gradually with their growth, so that at a certain period, a single caterpillar can devour all the leaves of a medium-sized plant.

The best means of controlling this insect is to plough the ground to a depth of 10-12 cm. as soon as the tobacco is harvested, this brings to the surface the hibernating chrysalids which are destroyed by the weather and birds. Hand-picking can be resorted to in the case of the young larvae, but spraying with mixtures such as copper arsenite and slaked lime, or lead arsenate, with the addition of copper sulphate is more effective.

Protoparce sexta var. *paphus* has many natural insect enemies, but the widest-spread, most numerous and most effective in Uruguay is a braconid hymenopteron (*Apanteles* sp.), an endophagous parasite of the larva which when parasitised usually dies before pupation. G. T.

216. *Otiorrhynchus raucus*, a Beetle Injurious to Cultivated Rhubarb in France.

Hoffmann A. Un Insecte nuisible à la Rhubarbe (*Curculionidae*). *Bulletin de la Soiété entomologique de France*, No. 18, pp. 233-234. Paris, 1923.

In the spring of 1923, many crops of rhubarb (*Rheum hybridum* and its garden varieties), at Rueil and Garches (in the Department of Seine-et-Oise) were attacked by *Otiorrhynchus raucus* F., thousands of specimens of this Curculionid devoured the leaves of the plants (showing a preference for those of the younger shoots) and soiled the leaves with their excrement thus arresting the growth of the rhubarb. The larvae live on the roots, but only destroy the outer layers.

The insect can be hindered in its depredations and even burnt, by frequent applications of quick-lime which should be spread early in the morning at intervals of some days and after heavy dew, or rain. G. T.

217. *Heilipus lauri*, a Coleopteron Injurious to the Avocado in Porto Rico.

Catoni, L. A. El picudo del aguacate. *Revista de Agricultura de Puerto Rico*, Vol. XI, No. VI, pp. 55-56. San Juan, P. R., 1923.

The Curculionid *Heilipus lauri*, populary known as " picudo del aguacate " (avocado weevil), is one of the insects that most frequently attacks the avocado in Porto Rico.

The principal injury is done by the larvae which excavate galleries in the boughs causing them to wither and dry up completely ; in addition, the caterpillars penetrate into the fruits until they reach the seeds where the insects complete their development and pass through the further stages of their metamorphosis. The fruits thus attacked usually remain small and are unfit for sale.

The control measures recommended are : 1) the immediate removal and burning of all branches attacked ; 2) stripping the bark from all the infected portions and the destruction of all the larvae thus discovered, after which, the wounds must be covered with a cement containing a considerable amount of corrosive sublimate ; 3) the collection and burning of all infected fruits, which are easily recognised by the presence of a hole on the surface : 4) picking the fruit by hand and destroying all the adult coleoptera found on the branches : 5) the up-rooting and burning of all trees that are severely infested by the parasite. G. T.

218. *Carpocapsa* sp., a Microlepidopteron Injurious to the Walnut in the Department of Vaucluse (France).

ZACHAREWICZ De la disparition du noyer dans le département de Vaucluse *Comptes rendus des séances de l'Académie d'Agriculture de France*, Vol. IX, No. 32, pp. 864-828. Paris, 1923.

Until a few years ago, walnuts were somewhat extensively cultivated in Vaucluse, but the area under these trees now continues to decrease, many individuals having been felled owing to the injury done to the crop by a Tortricide (*Carpocapsa* sp.), which attacks the nuts causing them generally to fall before they are ripe and rendering them uneatable.

The author, who discovered the identity of the pest, advises that all the parasitised nuts should be burnt, so as to destroy the larvae before they emerge ; he also recommends applying lime to the trunks of the trees and thus killing the caterpillars in their hiding places.

Although the long period of drought has been the main cause of the invasion of this insect, neglect is doubtless responsible for it to a certain extent. The reduction in the number of trees is attributable to the high price offered for timber which tempted the owners to fell all low-yielding trees.

The attacks of the microlepidopteron are, however, no argument against replanting Vaucluse with walnuts, which are very valuable trees. The author gives a summary of the necessary cultural operations.

G. T.

CURRENT NOTICES [1]

Legislative and Administrative Measures relating to Agriculture and Agricultural Industries.

219. **French West Africa.** — Decree of December 1923 re-organising the Agricultural, Stock-Breeding and Forestry Services, in the A. O. F. (*Journal Officiel*, No. 353, December 30, 1923).

220. **Algeria.** — Decree of November 22, 1923 ratifying the decision of the Algerian financial delegates regarding the payment for the disinfection of plants imported into Algeria. (*Ibidem*, No. 318, November 24, 1923).

Decree of July 15, 1923, containing regulations for the repression of the adulteration of wines. (*Bulletin Officiel du Gouvernement Général de l'Algérie*, No. 2575, 1923).

221. **Australia** (Queensland). — Law No. 3, August 20, 1923, relative to pest destroyers, fungicides, insecticides and weed killers. Amongst other regulations, it is required that each sample shall be in the original package or if sold in bulk, be in a sealed glass or earthernware jar or bottle bearing the prescribed label which shall set forth : 1) the distinctive name of the pest destroyer ; 2) the net weight ; 3) statement of the active constituents ; 4) all directions for use ; 5) name and address of wholesale dealer ; 6) such other matters as may be prescribed. The Minister of Agriculture may at any time order an official test of any pest destroyer, and results published in due course in the *Queensland Agricultural Journal* or as prescribed. The Governor in Council may from time to time make regulations with respect to all or any of the matters following :— *a*) defining and declaring what pest destroyers (of the various description) under this Act ; *b*) fixing and regulating standards for the constituents of pest destroyers ; *c*) procedure to be adopted by buyer ; *d*) forms to be used ; *e*) fees to be paid for analysis ; *f*) labelling of package. (*Queensland Government Gazette*, No. 65, August 27, 1923).

222. **Austria** (Lower Austria). *Law of January* 1923 *for the encouragement of Agriculture.* — A sum will be allocated in the annual budget of the country for the encouragement of Agriculture. The funds obtained will be devoted more especially to : 1) Agricultural and Forestry Instruction ; 2) Suppplementary Agricultural and Forestry Instruction ; Experimental and Research Institutes ; Experiment farms ; Institutes giving advice on farm management ; Official institutes for giving information about agricultural machines ; 3) Agri-

(1) In these notices the French alphabetical order is followed. (*Ed.*)

cultural and forestry co-operation; 4) Cultivation and protection of plants; 5) Encouraging the stock-breeding industry, including the rearing of small live-stock; encouraging the dairy industry, the cultivation of meadows and pastures; 6) Promoting the cultivation of fruit-trees; vines and kitchen-gardens; 7) Encouraging sericulture; 8) Combating infectious, or dangerous, stock-diseases; 9) Improving land for agriculture. (*Landesgesetzblatt für das Land Niederösterreich*, No. 8, March 28, 1923).

Laws Dealing with Seed Control: Upper Austria, law of February 23, 1921 (*Landesgesetz- und Verordnungsblatt für Oberösterreich*, Part 1, January 10, 1922) and Decree No. 65, May 11, 1922 (*Ibidem* Part 20, May 26, 1922).

Carinthia, Law of December 22, 1921 (*Landesgegetzblatt für Kärnten*, Part 9, February 28, 1922).

Laws Relating to the Improvement of Woodlands and Grazing-land: Upper Austria: Law No. 44, May 24, 1921, and Order No. 140, November 22, 1921, dealing with the abrogation of the regulations contained in the Imperial Letters Patent under date of July 5, 1853, and promulgating regulations for the rights of wood-cutting and of grazing (*Landesgetz- und Verordnungsblatt für Oberösterreich*, No. 13, March 9, 1922, No. 32, August 5, 1922. — Law No. 14, October 5, 1921 relating to pasture improvement (*Ibidem*, No. 6, January 31, 1922). — Order No. 105, July 29, 1922 relating to the protection of pastures and the encouragement of agriculture. (*Ibidem*, No. 32, August 5, 1922).

Lower Austria. — Order No. 120, September 25, 1923, dealing with the encouragement of agriculture and the cultivation of pastures. (*Landesgesetzblatt für das Land Niederösterreich*, No. 25, November 24, 1923).

Carinthia: Law No. 28, March 24, 1923 relating to the protection of mountains and alpine cultivation. (*Landesgesetzblatt für Kärnten*, No. 11, July 11, 1923).

Salzburg: Order No. 88, July 5, 1923, dealing with the protection of mountains and alpine cultivation (*Landesgesetzblatt für das Land Salzburg*, No. 25, July 13, 1923).

Styria: Order No. 237, April 8, 1921 relating to the abrogation of the regulations contained in the Imperial Letters Patent under date of July 5, 1853, and issuing new regulations concerning the rights of wood-cutting and grazing. (*Landesgesetzblatt für das Land Steiermark*, No. 60, September 30, 1922. — Order No. 37, February 22, 1923, dealing with the protection of mountains and alpine cultivation (*Ibidem*, No. 9, March 10, 1923).

Tyrol: Law No. 7, January 26, 1923 relating to the protection of mountains and alpine cultivation. (*Landesgesetz- und Verordnungsblatt für Tirol*, No. 4, March 4, 1923).

Laws for the Protection of the Alpine Flora:

Salzburg: Law No. 64, March 26, 1923 and No. 216 November 10, 1922, and No. 65, May 13, 1923 relating to the protection of the Alpine flora (*Landesgesetzblatt für das Land Salzburg*, No. 47, November 24, 1922; No. 19, May 24, 1923).

Styria: Law No. 86, May 8, 1923 relating to the protection of the Alpine Flora. (*Landesgesetzblatt für das Land Steiermark*, No. 21, July 27, 1923).

Laws for the Encouragement of Stock-breeding. — *Styria*: Law No. 247, March 14, 1922 (*Ibidem*, No. 61, October 14, 1922). — *Tyrol*: Law No. 58,

March 8, 1921, and Order of April 19, 1922, respecting the breeding of breeding stock. (*Landesgesetz- und Verordnungsblatt für Tyrol*, No. 25, May 17, 1922).

223. **Belgium.** — Royal Order, October 4, 1923, Making compulsory for sugar manufacturers, the physical purification of waste waters turned into water courses. (*Moniteur belge*, No. 279, October 6, 1923).

224. **Brazil**: Decree No. 16131 (August 28, 1923) approving the putting into force of law No. 4540 of February 6, 1922 (See Institut International de Législation agricole an. XII, 1922, p. 210) and authorising the Government, by means of the Ministry of Agriculture, Industry and Commerce, to encourage the cultivation and the industry of manioca. (*Diario official*, No. 199, August 28, 1923).

Decree No. 16 154 of September 15, 1923, fixing the concessions and grants to be made for the development of sericulture. To the first three legally constituted firms in the country having a capital of not less than 1500 *contos* of *reis* which shall engage in sericulture shall be granted : *a*) exemption from Customs Dues on all imported sericultural material; *b*) a grant of 10 *milreis* per ounce of selected silk-worm " seed " for breeding purposes ; *c*) a grant of 100 *milreis* per thousand mulberry trees distributed ; *d*) a premium of 3 *milreis* per kg. of reeled silk produced (Art. 1). In order to be eligible for these grants etc., it is necessary to : produce at least 1000 oz. of selected silkworm " seed " annually ; distribute mulberry trees ; carry out propaganda for the adoption of systematic methods of silkworm-rearing ; study the epizootic diseases of the silkworm.

225. **Canada** (Ontario). — An Act to amend the Reforestation Act, 1921, 27 March 1923, (*Statutes of Ontario*, ch. 10, p. 33, 1923). — **Law relative** to the date of application of regulations concerning testing, inspection and **sale of seeds.** (*Canada Gazette*, No. 15, 13 October, 1923). — **An Act to** amend the Agricultural Development Act. 8 May 1923 (*Statutes of the Province of Ontario*, ch. 15, p. 41 1923). — An Act to encourage the Consolidation of Cheese Factories, 8 May 1923. (*Ibidem*, ch. 16, p 43, 1923). — An Act respecting Inquiries as to the Grain Trade in Ontario, 8 May 1923. (*Ibidem*, ch. 17, p. 45, 1923).

226. **Costa Rica** : Decree No. 21 (October 27, 1923) prohibiting the importation of Coffee seeds, plants or portions of plants of whatever origin. (*La Gaceta*, October 28, 1923).

227. **Denmark** : Decree No. 242, (April 14, 1923) giving information respecting the treatment of infectious anaemia in horses ; No. 243 (April 14, 1923) information regarding thrush in horses (*Lovtidenden*, No. 29, June 12, 1923).

Egypt : *Regulations relating to plants and seeds, etc.* — The importation is prohibited of cotton plants, seeds of cotton, cotton ginned or unginned, vine leaves (whether as merchandise or packing), living insects, their eggs, larvae and pupae, and bacteria or fungi harmful to plants. The importation of date-palm trees, banana plants (Musaceae), sugar-cane, olive trees (and any other plant the Ministry of Agriculture decrees), green olives, silkworm eggs, and honey bees, is prohibited except under authorisation of the Ministry of Agriculture. This applies to the importation in transit of cotton, ginned or unginned, and seeds of cotton. The Ministry of Agriculture can prohibit

the importation of any fruit, vegetable, or seed that might prove a danger to agriculture and that would be difficult to fumigate. Packages imported contrary to regulations must be re-exported within a specified time, otherwise they are liable to be destroyed without any compensation.

If on inspection potatoes are found to be infected with Black Scab or Wart Disease (*Synchytrium endobioticum*) they will be destroyed immediately without compensation.

All living plants (except those conforming to the arrêté of November 24, 1919) are disinfected at the consignee's expense. Plants arriving by post are alone fumigated on arrival at the expense of the Ministry of Agriculture.

Fruits infected with certain diseases, or consignments from countries declared infected with those diseases, are disinfected.

Mangoes, nuts and cucurbitaceous fruits of Asiatic origin are allowed to enter Egypt only when accompanied by a certificate from the Entomological Service of the exporting country, that no species of *Dacus* or *Cryptorhynchus* capable of attacking these fruits or their seeds occurs in the country of origin or the country of exportation. But watermelons from Palestine are allowed if after careful examination by the delegate of the Ministry of Agriculture they are found to be free from plant disease.

The importation is prohibited of all plants in pots or in soil originating from the Riviera and all other localities infected by the Argentine Ant (*Iridomyrmex humilis* Mayr. var. *arrogans* Santschi).

With regard to plants being exported there are no regulations but on the request of the exporter plants are fumigated and certificates certifying this are given. No certificates are given guaranteeing freedom from all diseases of exported plants.

Order (*September* 16, 1923) rendering compulsory the fumigation of all trees in gardens situated in localities declared to be under treatment for the destruction of the scale-insect, *Aspidiotus adonidum*. (*Journal officiel*, No. 93, (September 20, 1923).

Order (*September* 16, 1923) fixing the date in 1923 before which operations for the destruction of lepidoptera attacking cotton-bolls and cotton seed must be carried out. (*Ibidem*, No. 93).

229. **Spain:** (*Enquiry regarding the production, sale and prices of the different fertilisers used by agriculturists*. Royal Decree of October 29, 1923 requiring the agronomic Staff of the General Direction of Agriculture and Forests to make enquiries respecting chemical fertilisers. (*Gaceta de Madrid*, No. 303, October 30, 1923). — Royal Order of November 5, 1923 issuing regulations for the carrying out of the part of the said enquiry entrusted to the agronomic Staff temporarily engaged for this work. (*Ibidem*, No. 310, November 6, 1923).

Regulations in favour of Cotton Cultivation:

1) Royal Decree (June 1, 1923) a Commission has been appointed to draft the scheme for the execution of the above decree.

The Government will lay before the Cortes a bill showing the sums at disposals for the encouragement of cotton-growing within the national territory (*Ibidem* No. 153, June 2, 1923).

2) Royal Decree (October 11, 1923) assigning an annual sum of 2 million pesetas for a term of 5 years to be expended in carrying into effect the

provisions of the Royal Decree (June 1, 1923) respecting cotton cultivation in Spain. (*Ibidem*, No. 285, October 12, 1923).

3) Royal Order (November 10, 1923) approving of the execution of the Royal Decrees (of June 1 and November 11, 1923) for the encouragement of cotton-cultivation in Spain. (*Ibidem* No. 317, November 13, 1923).

4) Royal Order (December 14, 1923) to the effect that agriculturists desirous of devoting their land and time to the cultivation of cotton shall receive State aid on application to the " Comisaría Algodonera del Estado" or to its general or local delegates. (*Ibidem*, No. 349, December 15, 1923).

Locust Control: 1) Royal Order (September 27, 1923), making it compulsory to bring to the notice of Civil Governors of provinces invaded by locusts the regulations of the Order under date of June 19, 1923. (*Ibidem*, No. 271, September 28, 1923).

2) Royal Order (October 22, 1923) setting forth the regulations for completing the cleaning of land where locusts eggs exist (*Ibidem*, No. 297, October 24, 1923).

3) Royal Order (November 16, 1923) reminding the Civil Governors, and Provincial Councillors of the " fomento ", and the Chief engineers of the Agronomic Sections of the provinces invaded by locusts of their duty to scrupulously carry out the provisions of the Boyal Decree of October 22, 1923 regarding the scarification of the land and other similar operations. (*Ibidem*, November 20, 1923).

Control of the Olive-Trees Pests : Circular of November 19, 1923, communicating the Royal Order of the " Ministerio del Fomento " which contains the regulations for the control of two species of insect attacking the olive-tree *Phloeotribus scarabaeoides* and *Phloeothrips oleae*. (*Ibidem*, No. 324, November 20, 1923).

230. **United States.** — United States Act respecting Grain Futures. In this Review for July-September, 1923, p. 790, it is stated that this Act " forbids operations in grain futures ", whereas the Act does not prohibit nor limit speculation, but gives the Secretary of Agriculture supervision over the speculative markets. Section 4 reads — that it shall be unlawful for any person to transmit through the mails etc. . . except, *b*) where such contract is made by or through a member of a board of trade (grain exchange) which has been designated by the Secretary of Agriculture as a " contract market ", and if such contract is in writing, showing date, parties to contract, addresses, property covered, price and terms of delivery. Such record shall at all times be open to the inspection of any representative of the U. S. Dept. of Agriculture, or the U. S. Dept. of Justice.

Importation of Live Stock into the United States of America. The Government of the United States has withdrawn its prohibition to the importation of cattle, goats (including Angora goats), sheep, other ruminants and swine from the Union of South Africa, subject to compliance with the regulations governing the importation, under permit, of domestic live stock and other animals into the United States. (*Journal of the Department of Agriculture, Union of South Africa*, Vol. VIII, No. 1, Pretoria, 1924).

Arizona : Law regulating camp fires and wilful destruction by fire. (*House Bill*, No. 164, chap. 53, March 10, 1923).

Arizona : Law regulating State control of tuberculosis, anthrax and other diseases dangerous to human health and life among dairy cows (*House Bill*, No. 24, chap. 69, March 12, 1923).

Arizona : Act for the protection of farming lands and farming communities providing for the elimination of obnoxious weeds, and the organisation of "antinoxious weed districts" etc. (*Senate Bill*, No. 80, chap. 20, March 1, 1923).

California : The fruit and vegetable standardisation Act. (*Amended Statutes* chap. 315, 1923).

Maine : Law relating to the packing and grading of apples. (*Public Laws of the State of Maine, passed by the 81st Legislature*, chap. 94, 1923).

Maine : Law relating to the protection of deer and fur bearing animals. (*Public Laws, passed by 81st Legislature*. chap. 212 and 214, 1923).

Maine : Law for control and suppression of the European Corn Borer. (*Ibidem* chap, 134, 1923).

Michigan : Law to promote agricultural interests of the State and to create a State department of agriculture ; to define the powers and duties thereof, etc. (*House enrolled Act*, No. 33, State of Michigan, 52nd Legislature, Session of 1923).

Michigan : Law to provide for inspection of commercial fertilisers and to regulate the sale thereof etc. (*House Enrolled Act No.* 147, 1923).

Michigan : Regulation of selling, offering or exposing for sale of agricultural seeds. (*Senate enrolled Act*, No. 149, 52nd Legislation Regular Session, 1923).

Michigan : Law to provide for standard grades for grapes, for inspection, etc. (*House Enrolled Act*, No. 32, 1923).

Michigan : Law to provide for prevention and suppression of diseases of livestock, contagious, infectious and communicable and to provide for the creation of a Department of Animal Industry. (*House Enrolled Act*, No. 51, 1923.

Michigan : Law for suppression of contagious diseases among bees. (*House Enrolled Act*, No. 136, 1923).

Michigan : Law to control the sale of milk, cream, skim milk, buttermilk, condensed or evaporated milk, and any fluid derivatives etc. (*House Enrolled Act*, No. 12, 1923) ; Cheese regulations (*Senate Enrolled Act* No. 14, 52nd Legislature, 1923).

Michigan : Law to prevent the importation from other States and the spread within this State of dangerous insects and contagious diseases affecting cultivated plant and fruits. (*House Enrolment Act*. No. 150, 1923).

Vermont : Laws relating to expenditure of moneys appropriated for the agricultural extension service. (*Public Acts of the General Assembly*, 1923, No. 71).

Vermont : Law to regulate the sale of commercial feeding stuffs. (*Ibidem* No. 111).

Vermont : Laws relating to control of plant pests. (*Ibidem* No. [illegible]).

Wisconsin : Law relating to the Department of Agriculture, barberry eradication, etc. (*Laws of* 1923), chap. 417).

Wisconsin : Law to amend the Statutes relating to the eradication of tuberculosis among cattle. (*Ibidem* chap. 442).

231. **France :** *Increase in Agricultural Production Agricultural Experiment and Instruction* : 1) Decree (Nov. 5, 1923), preceded by a report addressed to the President of the Republic, organising scientific enquiries with a view to increased agricultural production. (*Journal officiel*, No. 301, November 6, 1923). — 2) Decree November 10, 1923, appointing a Commission to consider improvements connected with forests and pastures, and increased facilities for tourists. To this Decree is appended an Order nominating the members of the said Commission. (*Ibidem*, No. 312, November 18, 1923). — 3) Order (September 24, 1923) dealing with the working of the " École supérieure du génie rural ". (*Ibidem*, No. 314, November 20, 1923). — Order (October 25, 1923) regulating the organisation and working of winter and temporary agricultural schools. (*Ibidem*, No. 298, November 2-3, 1923). — 5) Decree (October 25, 1923) dealing with the organisation of phytogenetic researches (*Ibidem*, No. 293, October 28, 1923). — 6) Decree (December 17, 1923) organising the work of agricultural cinematography. (*Ibidem* No. 342, December 18, 1923).

Seeds : 1) Decree (December 5, 1922) instituting a register of selected plants and appointing a Committee for seed-testing. (*Bulletin de l'Office des Renseignements agricoles*, No. 1, October 15, 1923). — 2) Decree (January 12, 1923) nominating the members of the seed control Committee. (*Ibidem*, October 15, 1923).

Sugar Beets. Decree (November 29, 1923) appointing a Higher Commission and District Commissions to study questions relating to the increase of sugar-beet production. (*Journal officiel*, November 30, 1923).

Stock-Breeding Industry : 1) Decree (January 27, 1923) dealing with the passing and licensing of privately owned stallions. (*Bulletin de l'Office des Renseignements agricoles* No. 1, October 15, 1923. — Decree (July 13, 1923) appointing a Higher Committee of Herdbooks etc. of French country live-stock. (*Journal Officiel*, No. 200, July 26, 1923).

Machine Cultivation. Distribution of Electric Power in Country Districts : Decree (February 7, 1923) defining the powers of the " Comité central de culture mécanique " appointed by the law of May 10, 1921 (See : *Institut International d'Agriculture, Annuaire International de Législation agricole*, Year XI, 1921, p. 623). (*Bulletin de l'Office des Rensiegnements agricoles* No. 1, October 15, 1923). — 2) Decree (December 13, 1923) containing the provisions of the Public Administration for the application of the law of August 2, 1923 facilitating, by means of State loans, the distribution of electric power in country districts. (*Journal officiel*, No. 339, December 15, 1923). — 3) Decree (December 13, 1923) appointing a Commission to study the general scheme of the distribution of electric power in France. (*Ibidem*, December 19, 1923).

Agricultural Co-operation : Law (July 12, 1923) facilitating the formation of the co-operative societies and the agricultural societies of collective interest considered in Art. 22 of the low of August 5, 1920 (See : *Institut International d'Agriculture, Annuaire International de Législation agricole*, Year X, 1920, pp. 552 et seg.) which gives the statutes of these societies (*Journal officiel* No. 189, July 14, 1923).

232. **Great Britain.** Law of the Minister of Agriculture and Fisheries, dealing with the *Restriction on Importation of Daffodil and Narcissus Bulbs*. The landing in the Scilly Islands of any Daffodil or Narcissus bulbs is prohibited unless each package or consignment thereof has attached thereto or is accompanied by :—

(*a*) In the case of bulbs grown in England, Wales, Scotland, Northern Ireland, the Irish Free State, or the Channel Islands, a certificate issued by a duly authorised official of the relative Department of Agriculture that he has examined the bulbs and found them to be clean and free from disease,

(*b*) In the case of bulbs grown in any other country, the copy certificate prescribed in the Destructive Insects and Pests Order of 1922 or

(*c*) A declaration that the bulbs have been immersed for a period of three hours in water retained at a temperature of 100° F. This declaration shall be signed by or on behalf of the approved person who has carried out the treatment and shall be made not more than three months prior to the date of shipment.

233. **Greece.** *Development of Agriculture.* Royal Decree (June 28, 1923) prolonging the period of the application of extraordinary measures for the development of agriculture. (*Journal du Gouvernement du Royaume de Grèce*, July 2, 1923).

Olive-trees : 1) Royal Decree (December 19, 1922) prohibiting, throughout all the Kingdom, the destructive cutting of olive-trees. (*Ibidem*, December 21, 1922). — 2) Decree (November 6, 1923) dealing with the "Olive Bank" and the organisation of the Phytopathological Service (*Ibidem*, November 6, 1923). — 3) Decree (December 3, 1923) respecting the coming into force of law No. 2895 on the institution of the "Olive Bank" (*Ibidem*, December 14, 1923).

Raisins. Decree (June 29, 1923) regarding the drying of grapes in Crete. (*Ibidem*, July 5, 1923).

Phytopathological Service. Decree (May 26, 1923) dealing with the organisation of the Central Phytopathological Service (*Ibidem*, May 30, 1923).

234. **Honduras.** *Free Exportation of Coffee.* — The free exportation of coffee without Government or municipal tax has been extended for another five years from May 1, 1923. (*Bulletin of the Pan American Union*, p. 508, November, Washington D. C., 1923).

235. **Indo-China.** — Order (August 23, 1923) respecting the protection of the sugar-cane against "Fiji Disease" (*Journal officiel de l'Indochine française*, No. 69, August 29, 1923).

Cambodia. — Order of April 12, 1923, for the formation of an Economic Museum on the premises of the Agricultural and Commercial Services of Cambodia. *Bulletin administratif du Cambodge*, No. 4, April 1923).

236. **Italy.** — *Encouragement of Sylviculture and Keeping of Stock.* Royal Decree (No. 2282, October 7, 1923) amending the provisions in force for the encouragement of sylviculture and keeping of stock. (*Gazzetta ufficiale del Regno d'Italia*, No. 261, October 7, 1923).

Prize for the Encouragement of the Citrus Industry. Under the Royal Decree of December 1923, No. 2742, a prize has been instituted for the best studies, researches or inventions connected with the citrus industry, or its by-products,

or the diseases of citrus trees and the means of controlling them. (*Ibidem*, January, 1 and 2, 1924).

Protection against Plant Diseases : 1) Amongst the various Advisory and Administrative Bodies instituted at the Ministry of National Economy under the Royal Decree of December 2, 1923, No. 2700, is included the Committeee for Protection Against Plant Diseases (*Ibidem*, No. 303, December 27, 1923). — 2) A Royal Decree (December 30, 1923), has published the regulations for the institution, at the Italian Ministry of National Economy), (*Economia nazionale* of the Advisory Committee for Protection Against Plant Diseases (*Ibidem*, No. 25, January 30, 1924). — 3) It having been proved that bananas coming from the Canary Isles are frequently infected by the scale-insect, *Pseudococcus comstocki*, Kuw. which attacks not only bananas, but many other, plants, such as the mulberry, apple, and pear, the Ministry of National Economy, General Direction of Agriculture, has decreed by means of circular No. 402, January 31, 1924, that the precautions prescribed in the first clause of Art. 17 of the regulation for carrying into effect the law of June 26, 1913, No. 888, approved by the Decree law of March 12, 1916, No. 723 shall be taken in the case of all bananas of whatever origin. Therefore, the Phytopathological delegates appointed to serve in the Vigilance Service at the ports and frontier Stations must on the written request of those interested give a written permit for the importation of bananas from countries regarded as free from *Pseudococcus*. In the case of bananas from countries believed to be infected, it is necessary, before granting the importation permit, to obtain from the interested parties a declaration to the effect that the said parties undertake at their risk and peril, to subject the bananas on their arrival at the ports, or stations, to a process of disinfection to be carried out before the phytopathological delegate in the manner prescribed by the Royal Regional Observatory of Phytopathology of the district in which the port, or frontier, station is situated. This disinfection will be omitted in the case of consignments of bananas accompanied by a certificate given by the phytopathological authorities of the country of origin and declaring the bananas to be free from *Pseudococcus comstocki*, and which have been recognised as immune by the phytopathological delegate appointed to examine them.

The Royal Customs Official at the frontiers shall admit, before phytological inspection, only such consignments of bananas as are provided with the afore-mentioned permit.

The foreign countries in which the presence of the banana scale-insect has so far been ascertained are as follows : China, Japan, United States of North America and the Canary Isles. — 4) Ministerial Decree (October 2, 1923) completing the provisions already in force and containing new measures for the prevention and treatment of the Ink Disease of the chestnut tree (*Gazzetta Ufficiale del Regno d'Italia*, No. 240, October 12, 1923). — 5) Royal Decree No. 2465 (October 15, 1923) authorising the execution in Italy and her two colonies of the measures approved by the Convention for the organisation of locust control signed in Rome, October 31, 1920. (*Ibidem*, No. 281, November 30, 1923).

237. **Luxembourg** (Grand Duchy of). — Order (November 17, 1923) respecting the supervision of nursery gardens of all kinds, as well as of gardens and

greenhouses, and dealing with certificates for the above in accordance with the Berne Phylloxera Convention. (*Mémorial du Grand-Duché de Luxembourg*, No. 58, November 17, 1923).

238. **Morocco.** — "Dahir". (August 29, 1923) rendering compulsory the adoption of the metric-decimal system in the French zone of the Sheriffian Empire. (*Bulletin officiel*, No. 568, September 11, 1923). — "Dahir" (June 14, 1923) ratifying the convention of Rome relating to Locust Control. (*Ibidem*. No. 581, December 11, 1923).

239. **Mauritius.** (Isle of). — Order No. 29 (November 10, 1923) appointing a Forestry Commission. (*The Government Gazette, Mauritius*, No. 90, November 10, 1923).

240. **Mexico.** — Decree (February 12, 1923) approving the Convention between Mexico and other nations for locusts control. (*Diario oficial*, No. 49).

241. **Paraguay.** — Decree 16 275 giving the agricultural defence provisions to be adopted for the protection of cotton. (*Diario oficial*, No. 848, July 19, 1923).

242. **Holland.** — Decree (August 15, 1923) respecting State Aid for the encouragement of horse-breeding. (*Staatsblad van het Koninkrijk der Nederlanden*, No. 409, 1923).

Decree (August 27, 1923) regulating the importation and transit of flower-bulbs and tubers with a view to preventing the spread of the animal and vegetable parasites of cultivated plants. From June 1 to the end of October, no flower bulbs, or tubers, may be imported, unless they have been examined and pronounced healthy by the phytopathological authorities. If diseased, the said bulbs and tubers must be disinfected, or destroyed, or else returned to the sender. Packets sent by parcel-post are exempted from inspection. Bulbs and tubers passing through the country are exempt from inspection provided they are properly packed and are re-exported without being opened, or removed from the van, and are officially sealed. (*Ibidem*, No. 416, November 1923).

243. **Peru.** — Decree No. 16 245 (June 20, 1923) containing the provisions of law No 160 (*Diario oficial*, No. 840). Law No. 4663 (May 5, 1923) dealing with the water supply of houses. (*El Peruano* No. 115).

244. **Portugal.** — Decree No. 9247 (November 15, 1923) requiring that all phytopathological work, whether laboratory research, or the carrying out of prophylactic measures against plant diseases, and the supervision of such work shall be entrusted to the Phytopathological Laboratory of Almeida. The Decree also contains provisions for the execution of this work. (*Diario do Govêrno*, Series 1, No. 243, November 15, 1923).

245. **Rumania.** — Law (September 30, 1923) relating to the organisation of forestry instruction. (*Monitorul Oficial*, No. 139, September 13, 1923).

246. **Kingdom of Serbians, Croats and Slovians.** — Regulation (July 13, 1923) respecting seed production importation and trade, and dealing also with the prevention, treatment and diagnosis of the contagious diseases of country live-stock. (*Službene Novine*, No. 164, July 21, 1923).

Regulation (November 3, 1923) regarding the institution of Stock-Breeding Stations. (*Ibidem*, No. 272, November 26, 1923).

Regulation (November 16, 1923) respecting the application of the law dealing with State Stud Stations (*Ibidem*, No. 273, November 27, 1923).

247. **Salvador.** — Decree (May 1, 1923) adopting a new system of marking adult cattle. (*Diario Oficial* No. 101).

248. **Sweden,** — Royal Order (November 12, 1923) containing regulations for the approval of State stallions. (*Svensk Författningssamling*, Nos. 399-409, November 28, 1923).

249. **Tunisia** (Regency of). — Decree (July 5, 1923) regulating the measures to be adopted for the prevention and control of forest fires. (*Journal officiel tunisien*, No. 78, September 29, 1923).

Order (June 26, 1923) regulating the method of sale and the conditions of use of poisonous substances employed for the destruction of parasites injurious to Agriculture. (*Ibidem*, No. 84, October 20, 1923).

Decrees (September 1 and September 15, 1923) approving the agreement signed between the countries of North-Equatorial Africa with a view to locust control. (*Ibidem*, No. 91 November 14, 1923).

250. **Uruguay.** — Decrees (September 7, 1923, and September 25, 1923) requiring the Office of Agricultural Economy and Statistics to draw up an agro-economic and an industrial census for the country for 1923. (*Diario official*, No. 5224, September 10, 1923, No. 5237 September 27, 1923).

Decree (December 11, 1923) dividing the territory of the Republic into three zones in order to facilitate tick control. (*Ibidem*, No. 5304, December 18, 1923).

Agriculture in Different Countries.

251. **Belgium.** *The Present Situation of Agriculture.* — The author of this pamphlet M. J. VAN DER VAREN (Professor of Rural Economy, Louvain University, Head of the Ministry of Agriculture, Belgium), has considered agriculture in Belgium in its many aspects under the following headings :— Distribution of population, territorial divisions, enumeration and extent of crops, agricultural population, farm labour, wages, land tenure, selling price of land, rental value, import dues, crop distribution, changes during the past 50 years in the extent of the chief crops, horticulture, live-stock, uncultivated land, capital invested in agriculture, agricultural products insufficient for national requirements, exports of farm produce. (*La situation actuelle de l'Agriculture belge*, pp. 23. Louvain, 1923).

252. **Brazil.** *Industry of Dairy Products.* — According to the report of Signor P. DE MORAES, the dairy products industry is much developed in Brazil, especially in the State of Minas Geraes where cheese has been manufactured since Colonial times, and butter-making dates from 1880. In 1918, this State possessed 733 butter-factories, 442 cheese factories and 2 factories for casein, lately the number of all these factories has increased, while 3 factories of condensed milk and one of milk-sugar have been started, and a lactic acid factory is about to be opened. In 1921, the State of Minas exported 16 280 tons of milk, 4000 tons of butter and 7560 tons of cheese ; the total value of these exports was over 148 million milreis, viz. 10 % of the value of the entire exports of the State.

There are 582 000 head of cattle in the State of Rio de Janeiro, most of which are cows; the latter produce 900 tons of milk, 35 tons butter, 64 tons of cheese and "ricotta" and 11 tons of cream. The consumption however exceeds the production. In 1921, 263 tons of condensed milk, 1.3 ton butter and 67 tons of cheese were imported into Brazil. (*A Lacticultura no Brazil. A Lavoura*, Year XXVII, No. 9, pp. 703-705; Rio de Janeiro, 1923).

253 **West-Indies.** *Report of Director of Agriculture of Trinidad for Year 1922.* — The annual report for Trinidad and Tobago, which is just to hand, states that the production of sugar during 1922 was 59 948 tons, the largest since 1917. The raising of seedling cane has been continued, and of the large number investigated six were selected for trial on estates and a number of new varieties were tested. Mosaic disease has been kept under control by systematic weekly inspections, as a result of which the fields are almost clear of the disease; the disease-free areas have increased during the year from 35 to 64 % of the whole. (*Louisiana Planter and Sugar Manufacturer*, Vol. LXXI, No. 15, October, 1923).

254. **Barbadoes and Antigua.** *Sugar-cane Cultivation.* — The Barbados Agricultural Society have requested the Governor to appoint a Commission to enquire into the working of the local Department of Agriculture with a view to its better equipment. The resolution authorising the request was moved by the Director of the Department of Agriculture, who stated that during the eight years 1913-15 and 1920-22, growers of cane in Barbados had benefited by the work of the Department to the extent of $ 10 000 000 and factory owners to a similar amount, as a result of growing better sugar-cane seedlings.

It is reported that all the varieties of Coimbatore cane seedlings sent to Antigua have germinated well and although the canes were only planted at the end of April or early May, they are ahead of many local plants six months older. (*The Agricultural Journal of India*, Vol. XIX, Part I, pp. 88-90. Calcutta, 1924).

255. **Italy.** *Production of Sugar.* — The sugar consumption in Italy has risen from 6 lb. per head per annum in 1909 to 17.2 lb. in recent years. In 1913 the acreage under sugar beet was 164 000 acres; in 1923 it was 223 000 acres. The industry now represents 400 million lire, and is carried on in 30 sugar mills and 12 refineries. The mills can deal with 40 000 metric tons of beet per day, and the daily output of sugar is estimated at over 200 metric tons; it is expected that the output from the 1923 crop will exceed 300 000 metric tons, thus exceeding that of 1913, the former record output of 268 940 metric tons. The excise duty on sugar in Italy is 300 lire per quintal, and the customs duty, 21 00 gold lire per quintal. (*The International Sugar Journal*, Vol. XXIV, No. 301. January 1924).

256. **Mauritius.** *Sugar production during 1922-1923.* — The Annual Report of the Mauritius Department of Agriculture states that the production of sugar for the 1922-1923 crop was about 8½ % below normal. The number of factories at work was 52, a reduction of 2. The area under cultivation is given as 170 000 acres, a reduction of 5000 acres from the previous year. The labour difficulties and fall in price of sugar account for the decrease.

The irrigation experiment station was completed last year and investigations are now being carried out as to the requirements of sugar-cane

A large distillery has been completed during the year for the production of power alcohol. The sugar industry is interested in its success as great economy would be effected by the use of industrial alcohol as a motive power, especially for the use of tractors on cane lands. (*The Louisiana Planter and Sugar Manufactur*, Vol. LXXII, No. 3, New Orleans, 1924).

257. **Russia.** *Agricultural economic conditions in the Steppe region.* — C. TIETZE who has lived for 8 years in south-east Russia (Steppe region), describes the economic conditions prevailing in the area inhabited by the Cossaks, Basc,Kurds and Tartars. The question of rural economy amongst the Volga tribe and Russian peasant is also discussed, with a closing chapter dealing with the present situation under bolschevic control. (Die betriebswirfschaftliche Verhältnisse in den Steppengebieten Südostrusslands. *Landwirtschaftliche Jahrbücher* Vol. 58, No. 2, pp. 251-302, Berlin, 1923).

258. **Tanganyika Territory.** *Report of the Director of Agriculture for Year* 1922. — The Department of Agriculture has been largely occupied with instructing the native population in more modern methods of agriculture, and these activities have been greatest in connection with cotton, except in the Moshi and Arusha districts, where the production of coffee, and to a lesser extent that of chillies, has been the chief object of their work. A great deal of experimental work has been done in connection with cotton culture ; at the experimental stations native chiefs and people have been given demonstrations, and the outside districts have been toured by Agricultural officers. During the year 297 tons of cotton seed were distributed, and it is expected that double that quantity will be required for 1923. The cotton weevil has so far been seen only in the districts of Kilosa and Mikese, where it attacks the stem, branch bases and boll bases. The cotton stem girdler (*Alcides brevirostris*, Boh.), has not been seen. The pink bollworm (*Platyedra gossypiella*, Saunders), considered as the chief pest, is parasitised by a chalcid and a braconid, at present unidentified. There was a sharp outbreak of *Earias insulana*, Boisd. and *Chloridea obsoleta*, F., throughout the central areas in May-June, and also of the leaf-roller (*Sylepta derogata*, F.). Stainers were almost negligible.

Other crops include simsim, castor oil plant, maize, millet, beans and tobacco.

259. **Union of South Africa.** *Report of the Department of Agriculture for Year ended June* 30, 1923. — The December number of the Journal of the Department of Agriculture consists entirely of the Annual Report, full details being given as to agricultural education, veterinary research, sheep and wool, entomology, plant pathology, dairying, tobacco, cotton, horticulture, viticulture, co-operative societies, the Government Guano Islands, poultry, etc. (*The Journal of the Department of Agriculture of the Union of South Africa*, Vol. VII, No. 6, pp. 125, Pretoria, 1923).

260. *Flax Growing.* — As a result of the decline of flax production in Russia and Ireland new sources of supply are being sought, and South Africa appears to be one of the most suitable for flax growing on a large scale. The western part of Cape Province offers suitable conditions and Russian seed has been widely distributed amongst farmers. The experiment has been successful and the United States Trade Commissioner at Johannesburg considers that these flax experiments may result in the opening up of a new field for South

African agriculture. (*Journal of the Royal Society of Arts*, Vol. LXXII, No 3[illegible], p. 34. London, 1923).

Rural Hygiene.

261. *Bayer Remedy for Sleeping Sickness.* — The new remedy for sleeping sickness, " Bayer 205 " was discovered about three years ago at the Bayer Chemical Works, near Cologne, and has been tested recently in Central Africa ; the results have proved that it is far more effective than anything previously tried. The new compound contains only carbon, nitrogen and hydrogen and is a derivative of atoxyl.

In the case of cattle bitten by the tsetse-fly the results have not been so successful as with human beings, but the Bayer chemists are now attempting to modify " Bayer 205 " in order that it may cure cattle as well a men.

Dr. KLEINE and Dr. FISCHER tested the remedy during 1921 in Northern Rhodesia and in 1922 crossed into the Belgian Congo, treating in all 180 native patients. In the early stages of the disease striking improvements were shown after a few injections had been made ; the trypanosomes disappeared from the blood, and in most cases had not returned after several months, but it is too soon yet to give the percentage of patients that have been permanently cured.

The successful outcome of these experiments is of great importance over large areas of Central Africa, where the chief epidemics caused by trypanosomes are sleeping sickness in men and nagana in cattle. (*The Times Weekly Edition*, January 3, London, 1924).

262. **French Colonies.** *Hot Springs in the Atlantic Colonies of France.* — The most important thermal Stations are generally found in the colonies of volcanic origen. In Martinique, the hot springs are grouped together, in the northern part of the island, around Garbet, some kilometres from Fort-de-France.

Guadaloupe possesses sulphur springs (baths of Matouba, Gabion, Garbet and St. Charles) and saline springs (Dolé Station. At La Bouillant, a salt spring rises on the sea-shore at a temperature of 100°C. In Guiana, there are the alkaline and ferruginous springs of Sinnamary). The island of Cayenne has of a very strong iron spring at Baduel. Very few of these springs are, however, regularly visited, for the equipment is insufficient in nearly every case (M. LEBON. Sources thermales des Colonies françaises de l'Atlantique. *Annales de l'Institut Colonial de Bordeaux*, November 1923, p. 311-312).

263. **Samoa.** *Control of Malaria*, No. 22 (August 11, 1923) of the *Western Samoa Gazette* contains regulations for preventing the breeding of mosquitoes.

Experiment Stations and Agricultural Instruction.

264. **American Industry :** *Researches.* HASKELL, S. B. (Director of the Agricultural Experiment Station, Amherst, Mass.) shows that appropriation for agricultural research is not legislation in favour of a class. It is not a subsidy of agriculture. It is of more direct benefit to the consumer in the city than to the producer in the country. Continued development of those industries which in effect remove people from the ranks of food producers to those of

food consumers depends on increased efficiency on the farm ; and this in turn depends on continuation and intensification of all kinds of agricultural research. (*Journal of the American Society of Agronomy*, Vol. 15, No. 12, pp. 473-481, Albany, N. Y., 1923).

265. **Brazil.** *The Sugar Cane Manurial Experiment* carried out on the "Estação Geral Experimentação" of Campos (State of Rio Janeiro, Brazil) by the Director A. C. PESTANA have always given negative results whatever fertiliser, or combination of fertilisers was employed. The highest unit crop of sugar-cane has invariably been obtained by the unmanured plots. The author is now making researches with a view to ascertaining whether this fact is due to a degeneration of the sugar-cane that makes it unable to profit from a larger supply of nutritive substances. (*Ministerio de Agricultura, Industria e Commercio. Ensaios de ambação de canna de assucar.* Campos, 1923).

266. **Canada.** *Report of the Experimental Farms of the Dominion, for Year ending March* 31, 1923. — The Report of the Director of the Dominion Experimental Farms states that the average yields in bushels per acre throughout Canada were for the years 1922 and 1921 respectively : spring wheat, 17 $^3/_4$ and 13 ; oats 33 $^3/_4$ and 25 $^1/_4$; barley 27 $^3/_4$ and 21 $^1/_4$. The weights per measured bushel were higher than in the preceding year. Brief notes are given on the work of the Central Farm and that of the branch Farms and Stations. Fuller information is given in the separate detailed reports.

267. **Ecuador.** — Under an Order dated October 23, 1923, an Experiment Station for the Study of Live-Stock Diseases has been instituted. (*Registro oficial*, No. 910, October 25, 1923).

268. **Spain.** — By Royal Decree of October 20, 1923, the provisions relating to experiments in tobacco cultivation have been abrogated. (*Gaceta de Madrid*, No. 295, October 22, 1923,.

269. **United States.** *Recommended Standards for Field Plot Experiments in Soil Fertility.* — The Committee on Standardisation of Field Experiments recommends the adoption of certain standards, with a view to the adoption by all workers, of the same methods of procedure in carrying out field experiments.

The recommendations are considered, for soil fertility experiments, under the following heads : Location, uniformity of soil, topography, drainage, size of plots, shape of plots, marking of plots, frequency of check plants, treatment of check plants, untreated plots, replication of treatments, interspaces and borders, uniform stand of plants, cultural operations, determination of yields.

Recommendations for field crop experiments are given under the headings : Seed, soil, plots, check plots, replication of plots, removal of outside rows, mechanical operations, yield determination, publication and interpretation of results. (*Journal of the American Society of Agronomy*, Vol. No. 1, pp. 1-16, bibliography. Geneva, N. Y., 1924).

270. *A new Cotton-Boll Weevil Laboratory* has been established at Florence, S. C., by the Bureau of Entomology of the United States Department of Agriculture and the South Carolina Agricultural Experiment Station. (*Journal of the American Society of Agronomy*, Vol. 15, No. 10, 1923).

271. **European Agricultural Colleges.** — GONZALES, B. M. gives an account of the systems of education followed at agricultural colleges in Germany,

Belgium, France, Great Britain and Holland. The author made special inquiries respecting the extent of practical and scientific work accomplished by students, and also as to the subsequent life work of graduates. (*The Philippine Agriculturist*, Vol. XII, No. 2, pp. 57-62. Los Baños, 1923).

272. **Finland.** *Experiment Stations.* — Research in Finland is now being conducted mainly by eight institutions. The chief of these is the Central Agricultural Experiment Station, at Dickursby near Helsingfors, which is controlled by the Government. The work is organised into the usual departments, each being under the direction of a professor of the University of Helsingfors. Special attention is given to the breeding of oats. The Bureau for Examination of Butter and Edible Fats is situated at Hanzo; it examines butter for export and makes investigations on other food fats. The Economic Investigation Bureau at Helsingfors conducts inquiries based on data received from several hundred privately owned farms. The Geological Commission at Helsingfors carries out investigations on soils and prepares agro-geological maps. The Swamp Cultivation Experiment Station of Lettensuo, 75 miles north of Helsingfors carries out experiments on the cultivation, ditching and fertilising of swamps.

Similar stations are situated at Ilmajoki and at Tohmajarvi. The Plant Breeding Station of Tammisto at Malm, near Helsingfors is owned by the Hankkija Co-operative Society. In addition to the above, various cattle-breeding societies in Finland receive State aid. (*Science*, Vol. VIII, No. 1505 p. 415, Lancaster, Pa., U. S. A., 1923).

273. **Great Britain.** *The Work of the Intelligence Department of the Ministry of Agriculture and Fisheries, London.* — The Intelligence Department of the Ministry of Agriculture and Fisheries deals with agricultural education and research, horticulture, schemes for the improvement of live stock, horsebreeding, dairying, small live stock, the diseases of animals and the special training of ex-service men.

In the sphere of agricultural education the Ministry aims at providing throughout the country facilities of three kinds: (1) Agricultural Colleges and University Departments of Agriculture, of which at present there are eleven, provide a two or three years' course of technical instruction suitable for those who intend to become Occupiers or Managers of large farms, Land Agents, Teachers, Experts or Officials. (2) Farm Institutes, of which there were twelve in 1922, provide simpler Courses for those who cannot afford the time or who have not had the standard of general education which would enable them to take advantage of the college courses, and (3) Local Courses, evening lectures, demonstrations, etc. Grants are made direct in the case of the Colleges but in the case of Farm Institutes and local instruction the Local Authorities are held responsible and grants in proportion to the expenditure are made by the Ministry to the Local Authority.

A full account of the problems which the various Research Institutes are investigating has recently been set out in a semi-popular form in a special publication entitled "Agricultural Research and the Farmer". The status of the Research Worker is discussed and a description is given of the scheme which aims at providing the Research Worker with scope for advancement on the lines of other professions. An important part of the work is conduc-

tion with agricultural research is the dissemination of knowledge and advice to the practical farmer and a chain of advisers has been provided to meet the need. The farmer will commonly seek the assistance of the Country Agricultural Organiser or Instructor who, while not a specialist, has had a scientific training and is able to deal with most of the routine enquiries on which the practical farmer will want advice. For problems requiring detailed investigation or specialist's knowledge the Ministry has stationed at convenient provincial centres Advisory Officers who are specialists *e. g.* chemists, mycologists, entomologists, who will normally take such questions as the County Organiser cannot deal with personally. Finally there are the Research Institutes who may be called in exceptionally for assistance in problems of greater magnitude.

The schemes which were established after the War for the special training in agriculture of ex-service officers and men met with a very large measure of success, and had only to be brought to a conclusion because the prospects of employment in agriculture after the period of training provided an outlet for only a limited number of men.

The work of the Ministry in regard to horticulture has undergone considerable expansion since the war. Previously the Ministry's activities were mainly confined to the control of the more serious pests and the work of inspection etc. connected therewith. This work naturally still occupies a very important part of the attention of the Horticulture Branch, but with the increased importance which the war gave to the intensive cultivation of fruit and vegetables and the stimulus to land settlement and the cultivation of allotments which resulted from the war, there arose a need for education and technical advice and research, which the Department is endeavouring to meet.

In connection with the more recent development schemes, mention may be made of the progress which has been made during the last few years in the Ministry's efforts to bring about an improvement of the general run of live stock in the country. British pure bred stock enjoys an international reputation but much of the general farm stock has been of indifferent quality. The Ministry's scheme, which was inaugurated in 1914 assists stock owners in the purchase of good class bulls and boars. It has met with a very fair measure of success, approved bulls and boars having been distributed fairly generally throughout the country, and there is a clear indication that slowly the scheme is having the educational end desired in that the advantages gained from using good class sires is being increasingly recognised. Concurrently the practice of milk recording which the Ministry also encourages by making small grants to societies is making steady progress. Analogous to the bull and boar scheme for live stock improvement the Ministry has also a horse breeding scheme.

One of the more recent developments of the Ministry's Intelligence Department lies in connection with dairying and the small live stock industries. The work is very largely of an educational character. For example in the case of dairying the promotion of Cheese Schools has been undertaken in the endeavour to show the farmer how to deal on co-operative lines with surplus milk. Among other activities of the Ministry's Dairy Branch is the campaign directed to producing clean milk.

In regard to poultry, the Ministry is working through the County Authorities to provide throughout the country facilities for obtaining advice and instruction to help the poultry farmer and the smaller poultry keeper in their business, and concurrently with this, arrangements have been made for the distribution of sittings of eggs or day old chicks of good utility quality. A beginning only has been effected and further development is contemplated.

The activities of the Department in connection with animal diseases are exhaustively dealt with in a special report by the Chief Veterinary Officer (*Contributed by the Ministry of Agriculture and Fisheries, London*)

274. *Research Institutions and Advisory Centres.* V. E. WILKINS (Assistant Principal, Ministry of Agriculture and Fisheries) was asked by the Intelligence Department of the Ministry to collect materials and reduce them into a compact and intelligible form in order that the farmer and the public may be better acquainted with the extensive agricultural research which is being carried out in England.

This comprehensive work, written in non-scientific language, describes the main lines of research under the following headings:

The soil and its effect on plant growth; plant breeding, plant physiology; fruit growing and preserving; plant diseases; animal husbandry; animal breeding; dairying; farmings as a business.

A list of the Research Institutions and Advisory Centres in England and Wales is given, and the titles of papers published by research workers in 1920 and 1921, and also an index. (*Agricultural Research and the Farmer*, pp. 168, Ministry of Agriculture and Fisheries, London, 1922).

275. *Report of the Rothamsted Experimental Station for* 1921-22. — This Report, recently to hand, contains interesting information respecting the work carried out at this well-known station, which has been re-organised so as to bring it into touch with modern conditions of agriculture and science. Amongst some of the new nitrogenous manures being investigated are urea and ammonium chloride, both of which appear to be very valuable fertilisers. The new basic slags are also being studied. Artificial farmyard manure (1) is being made on a large scale at a number of centres; 2000 tons of straw have now been treated on different farms. The product, although not fully equal to true farmyard manure has the advantage that it does not lose nitrogen on exposure to weather. It is interesting to learn that a small quantity of boric acid is essential to the life of broad beans, and is beneficial to other plants. Under the head of "Expenditure and Cash Returns per acre" it is shown that a profit was made from October 1919 to September 1920, after which every crop on the farm was grown at a loss; the note is made that, from 1920 onwards the financial results are deplorable, and they show clearly why many of the arable farmers to-day are in their present position. For the year 1922-23 the Ministry of Agriculture has made a grant of £4145. to the Station.

(1) See *B.* 1922, No. 236. (*Ed.*).

Agricultural Institutions.

276. *International Wine Office.* — A resolution passed at the International Wine Conference (Paris, June, 4-6, 1923) had for its object the promotion amongst the various wine-making States of an *International Wine Office.* It was also decided to appoint a Commission composed of the representatives of the States taking part in the Conference (France, Greece, Italy, Portugal and Spain) to draft a Statute to be presented to the several States and submitted to the definitive approval of another conference to be held by their official representatives.

The task devolving upon the International Wine Office, as set forth in the scheme already drawn up by the Commission, will include : 1) the collection, study and publication without loss of time of all information tending to show the beneficial effects of wine ; 2) the sketching out of a programme of scientific experiments proving the hygienic properties of wine and its influence as a means of combating drunkenness ; 3) proposing to the Governments that they should adhere to the international conventions of October 12, 1912 which had for their objects : *a*) the assurance of a uniform method of recording the results of wine analyses ; *b*) the prosecution of a comparative study of the methods of analysis adopted by the various States, in order to obtain uniformity in these methods ; *c*) submitting for the approval of the Governments legislative measures tending to promote uniformity as regards : *a*) protection of names of origin of wines ; *b*) control of the wine trade ; *c*) a guarantee (in the form of certificate of origin) of the purity and authenticity of the products ; *d*) repression of adulteration and of unfair competition ; 5) the organisation of fairs, exhibitions etc., of wines in countries where wine is not in general use. (A. MARESCHALCHI, *L'Italia vinicola ed agraria*, 1923, No. 49).

277. *Milan. Cereal Exchange* — Through the initiative of the Chamber of Commerce of Milan, a Cereal Exchange has recently been instituted in that city.

Exhibitions and Competitions.

278. **Belgium.** *National Cultural Exhibition.* — The Delegation of the Producers of Chili Nitrate of Soda (43 Rue de l'Empereur, Antwerp) has organised for 1924, in every province of Belgium, a cultural competition of oats, potatoes, sugar-beets, mangels, forages, and meadows under hay crops. The sum of 50 000 francs will be given in prizes.

National Poultry Exhibition, Liege, *January* 19-21, 1924. — Organised by the Société Royale Union Avicole. For information, apply the Secretariat ; 39 Rue Dradin, Kinkenpois-Liege.

National Poultry Exhibition, Brussels, *March* 15-17, 1924. — Under the auspices of the Ministry of Agriculture, of the National Federation of Aviculture of Belgium, and Other Societies. Secretary M. C. Nol, 174, Avenue van Becelaere Watermael-lez-Brussels.

279. **France.** *Third National Exhibition-Fair of Ciders and Dairy Products Vimoutiers (Orne) April* 20-24, 1924. — For information apply to the Commissariat de la Foire, Exposition Vimoutiers.

280 **Great Britain.** *Implements and Machinery at the Smithfield Show.* — A report of the Smithfield show held at the Royal Agricultural Hall (London), in December 1923. Among the machines exhibited was a new type of combined rake-tedder and swathe-turner and a potato-lifter with the prongs arranged in such a manner as to place all the potatoes in rows (*Implements and Machinery Review*, Vol. 49, No. 584, pp. 910-934. London, 1923).

281 **Italy.** *The First International Exhibition of the Cheese Industry and Trade*, Milan, which was fixed for November 1923, has been postponed until April 1924. For further information apply to the Direzione generale del Comitato organizzatore, Milan, 7 Via Tigli, Casella postale, 812.

International Sample Fair, Milan, *August* 12-27, 1924. — Will also included an *International Show of Fat Cattle*, April 13-16. The animals will be divided into two categories, the first of Italian breeds and the second of foreign breeds. All communications to be addressed to: Concorsi zooteenici della Fiera di Milano.

An Italian Competition for the Largest Ear of Wheat has been announced by Prof. SAMARANI, Director of the Station of Agricultural Bacteriology at Crema. Two classes of entries will be allowed: ears and plants. The object of the competition is to show the good effect of applying fertilisers in small quantities and frequently, according to the old Roman method. The Ministry of Agriculture has offered several prizes.

Italian Competition for "la vittoria del grano". — Inaugurated by the newspaper, "Il Popolo d'Italia" under the auspices of the Ministry of Agriculture which has offered prizes to the value of 25 000 *lire*. All applications for entry to be made before April 22, 1924.

Congresses and Conferences.

282. **Belgium.** — *Rural Week* (*Louvain, December* 26, 29, 1923). — Organised by the "Ligue des paysans", or the Belgian Boerenbond (League of Christian Peasants).

This League holds every year, at the headquarters of Society, at Louvain, a series of "days of study" viz., conferences, to which are invited the Managers of its local syndicates. The last series during which Luytgaerens was president, was a great success eleven conferences being held by specialists. The chief conclusions reached may be summarised as follows: 1) Agriculture in Belgium is at least as important as industry hence these two branches of national activity should receive equal treatment from the public authorities whose policy should above all aim at supporting private initiative and co-operating with independent agricultural societies.

2) The social conditions of rural communes ought to be maintained at the same level as those of industrial communes. The instruction given in rural communes should be distinctly rural. Public assistance should be given, while the institution of loan societies especially for the benefit of agriculturists and agricultural workers, is one of the best forms of activity to which the "Boerenbond" can devote itself.

3) The possession of small holdings should be encouraged in every way by the State on account of its good social effect.

4) As regards the provisions for the improvement of cattle, it is requested that : *a*) the judges of breeding-stock should pay less attention to the aesthetic points of cattle and more to dairy and beef qualities ; *b*) such judges should include re-presentatives of the Provincial Federations of StockBreeders.

5) The public authorities should encourage private initiative in the selection of seed and in popularising the use of selected seed.

6) That professional instruction should be of a local character and imported in an earnest spirit as only thus can it be efficacious, practical, and within the compass of the great majority of the peasantry. In general, such instruction should devolve upon private initiative and especially upon private societies ; the State ought to confine itself to supporting its free action, or in exceptional cases, supplementing it.

7) It is advisable that the public authorities should recognised the beneficent work of the independent Societies and enter into closer relations with the latter by consulting them respecting the measures to be adopted, and assisting them in the schemes they have undertaken of their own initiative.

283. **Columbia.** *Coffee Conference.* — On the initiative of the Society of Agriculturists of Columbia the Government summoned in January at Cartagena an International Assembly representing the countries which produce mild (high grade) coffee. The following were represented : Mexico,Guatemala, Honduras, Salvador, Nicaragua, Costa Rica, Ecuador, Columbia, Venezuela, Jamaica, and Porto Rico. The Conference discussed the collection of statistics on tillage, cultivation, diseases of coffee, the formation of a standard type of mild coffee to serve as a basis in future transactions, the construction of warehouses at ports, etc. (*Tropical Agriculture*, Vol. 1, No. 2, p. 24. Imperial College of Tropical Agriculture, Trinidad, B. W. I., 1924).

284. **United States.** *American Association for the Advancement of Science* celebrated its 75th anniversary at Cincinnati from December 27, 1923, to January 2, 1924. In addition to the United States, representatives of the following countries were present : Canada, Holland, England, Hawaii, China, Japan, Porto Rico and Russia. Wonderful progress has been made in developing means of investigation and in recording the results of research, during the past 75 years. The development was well shown in the exhibition which was opened on December 28, in proximity to the rooms used by the Association. (*Science*, Vol. LIX, No. 1517. pp. 71-96. Lancaster, P. A., 1924).

Pan-Pacific Food Conservation Congress will meet in Honolulu from July 31 to August 14, 1924. Dr. L. O. Howard of the U. S. Department of Agriculture will open the conference. The sessions will be held at the Territorial Executive Building. Visits will be paid to sugar and pine-apple plantations and to the volcano of Kilauea. The conference will be held in ten sections as follows : International agreements regarding fisheries, economic entomology, plant pathology, international quarantine policies, crop production and improvement, forestry, climatology, transportation and distribution of food products, topography of land and sea, and animal husbandry. (*Science*, Vol. LIX, No. 1514, p. 12. Lancaster, P. A., 1924).

285. **France.** *Congress for Regulating the Water Supply.* Lille June 30, July 15, 1924. Organised by the " Ligue générale pour l'aménagement et l'utilisation des eaux ".

286. **Great Britain.** *Fourth International Congress of Refrigeration, London, June* 16 to 21, 1924. — The Congress, officially supported by the Governments of 47 countries is recognised as the focus of Refrigerating Interests in relation to all industrial and scientific applications and to overseas traffic. H. M. Government is providing accommodation and giving a State Banquet to the Congress in London. Papers will be read on scientific questions, refrigerating materials, general applications, land and marine transport, legislation, education and propaganda, economics and statistics. Excursions to refrigerating and other establishments in London and the Provinces will be arranged. Particulars may be obtained from the Hon. Secretary-General, Mr. J. Raymond, Weaver's Hall, 22 Basinghall Street, London, E. C. 2. (*Cold Storage*, Vol. XXVII, No. 311. February, 1924).

The British Association for the Advancement of Science. — The date of the meeting at Toronto has been changed by the Council of the Association from September to August 6-13. The main party will leave England about July 25, and the excursion tour will be after, instead of before, the meeting. The British Association will meet at Southampton in 1925. (*Nature*, Vol. 112, No. 2824, p. 874. London, December 1923).

Textiles Conference. — Arrangements are being made by the Textile Institute of Great Britain for an Empire Textile Conference to take place at the British Empire Exhibition during Whit-week (7-14 June). The objects of the conference are :—

1) To promote the commercial, technical and scientific advancement of the industry.

2) To promote closer relationship with the various parts of the Empire.

3) To bring together representatives of the textile industry.

4) To discuss problems associated with the production of raw materials. (*South African Journal of Industries*, Vol. VI, No. 12, p. 563. Pretoria, 1923.

287. **Italy.** *Convention for Beet-Cultivation in Italy*, Bologna, January 18, 1924. — Reports were presented by : Mugnerati (Direttore della R. Stazione di Bieticoltura di Rovigo) dealing with the application of the contract from the technical standpoint. — Marozzi, New Directions in Beet-Cultivation in Italy from the Economico-Social Point of View. — Pratolongo, Application of Potassic Salts and other Measures Adopted for the Improvement of Beet-Cultivation, etc. This Convention was organised by the Federazione Italiana Sindacati Agricoltori (F. I. S. A.), Bologna.

Pomological, Viticultural Congress, and National Fruit and Table-Grape Show Trent, October 1-12, 1924. Organised by the Trent Provincial Council of Agriculture.

National Italian Veterinary Congress, Pisa, October 8-10, 1923. On this occasion, Prof. Carlo Baldi of the Istituto Agrario Vegni (Le Cascine, Florence), made an important communication respecting the treatment of foot-and-mouth disease by means of external disinfection with a 4 % solution of copper sulphate, and internal disinfection by the ingestion of a solution of methylene blue.

Convention for the Protection of Grain Mould, Bologna, November 11, 1923. — Arranged by the Federazione Italiana Sindacati Agricoltori, Bologna.

Official reporter Prof. FASCETTI (Direttore dell'Istituto Sperimentale Caseificio di Lodi). The question of forming a Consortium among the producers of " Grana " cheese with the objects of protecting cheese manufacture ; collecting information regarding the making and marketing of dairy products ; the control production and trade ; the improvement of cheese making technique etc.

288. **Holland.** *International Phytopathological and Entomological Conference* at Wageningen, *June* 24-30, 1923. (See *International Review*, Vol. I, No. 1, p. 257, 1923). — Various countries were represented and reports have recently been published and T. A. C. SCHROEVERS intends to unite these in one volume of about 300 pages, with 9 figures in the text and 18 coloured plates.

Amongst the questions discussed at the Conference, special attention was given to the diseases of potatoes. The diseases and pests of other cultivated plants and methods of control were also discussed ; also the organisation and legislation concerning Phytopathological services and international collaboration. The " International Phytopathological and Entomological Committee " was formed with headquarters in Holland, with a view to the elaboration of suggestions put forward at this Conference and to collect all possible information relative to diseases and pests of plants and adequate means of control, taking into account the prevailing conditions in each country, etc.

289. **Philippines.** *Sugar Association.* — The first annual convention of the newly organised Philippine Sugar Association was held at Manila from October 6th to 12th. Reports were submitted by the different committees on cane diseases, cultivation, animal husbandry, mill data, sugar storage, manufacture of sugar and yields. Planters showed appreciation of the advantages of scientific agriculture.

There are now in the Philippines 32 large factories with a combined daily capacity of 24 970 tons of cane ; the crop capacity of these 32 factories is given as 374 550 tons of 96 % sugar. The modern method of estate supervision is shown by the employment of the aeroplane for inspection work on large plantations. (*The Louisiana Planter and Sugar Manufacturer*, Vol. LXXI, No. 24, New Orleans, La., 1923).

Miscellaneous.

290. **Russia.** — *The Metric System to be officially recognised*, as from January 1, 1927. The introduction will be gradual, under the control of a special interdepartmental metrical commission. Since March 10, 1923, the manufacture, sale and purchase of old weights and measures have been prohibited. Arrangements are to be made for instruction of the population in the metric system. The Customs and other State institutions have been instructed to introduce the metric system. (*Nature*, Vol. 113, No. 2829. London, Jan. 1924.

291. **North Africa,** *Hydraulic mesures Algeria. Scheme for regulating the water of the Tafna basin.* — F. DOUMERGE describes a series of barrage-reservoirs that to be constructed for the systematic regulation of the waters of the Tafna and of its affluents (Algeria), in order to utilise for agricultural purposes the large volume of water which at present flows directly into the sea and is lost.

(*Bulletin Agricole de l'Algérie-Tunisie-Maroc*, Year 29, No. 12, pp. 229-238. Algiers, 1923).

Morocco. — H. MARC describes how, by means of hydraulic rams, it was possible to supply water to Kasba Tadla (French Morocco) from the Oum-er-Rbia) a river with an abundant flow of water, but having a very turbulent and rapid course. (*La Nature*, No. 2570, pp. 713, figs. 10, Paris, 1923)

292. **Brazil.** *The Utilisation of Pteridium aquilinum.* — In *Chacaras e Quintaes* Vol. XVIII, Part 2, 1923 (Sao Paulo, Brazil), there is a description of the various uses of this cosmopolitan fern which grows like a weed in many places, frequently invading land where the trees have been lately felled. The young shoots serve as a vegetable and the rhizomes are made into bread (" pão de helecho ", of the Island of Teneriffe), while a decoction of the fronds is taken as an antirheumatic remedy.

293. **Italy.** *Wheat as a Paying Crop.* In *l'Italia agricola*, No. 12, 1923, Prof. E. BASSI, states that in countries where agriculture is intensive and progressive, wheat can hold its own as a profitable crop against any other commonly cultivated herbaceous plant and contributes in an efficient and special manner to the average unit return of the whole farm which alone can give an idea of its real productivity. The author examines the question with regard to its bearings on Northern Italy and the three agricultural methods usually practised in that part of the country.

1) In the classic wheat districts where the cereal is grown in rotation with industrial plants, and the proportion of artificial meadows is small, wheat is profitable, not only on account of its gross returns, but also because it allows of the ground being deeply ploughed in summer greatly to the advantage of the succeeding industrial and hoed crops ; further, the straw is a valuable fertiliser for the soil.

2) On irrigated land where the rotation includes temporarily irrigated pasture for milk production, and where wheat follows maize, and grass, the straw is of still greater importance ; in addition, the forage is much benefited by rotation with the cereal.

3) On irrigated, or damp soils, where the stock-breeding industry is combined with the raising of large industrial crops (beets, tomatoes and tobacco), wheat follows a cover-crop of grass, kitchen garden or industrial plants (tobacco), for it has the great merit of being carried quickly, thus leaving the land free.

294. *New Vine Varieties Recommended for Propagation.* — As a result of satisfactory tests made in the vineyard and in the Viticultural Experiment Station at San Marco, Cevoli (Province of Pisa), the author recommends the propagation of the following varieties :

For districts liable to frost (late varieties). — White grape Syrah direct hybrid bearers Coudère vars. Seibel and Gaillard No. 2 and No. 157.

For districts where conditions are adverse to ripening (between 400 to 700 m. altitude) : " Chiegniolo " (attractive wine) ; " Portoghese azzurro " (" Hâtier portugaiser ") (somewhat inferior wine) ; " Gamay " (" classe du Jura ") first quality wine.

For very vinous : " Grand noir de la Calmette " and " Alicante Bouschet ".

For districts subject to high wind and for upland areas : " Grenache ", " Picquepoule ".

These recommendations are applicable to Central Italy, in Tuscany. (Nuovi o poco noti vitigni da propagare. *l'Italia agricola*, Year 60, No. 8, pp. 328 331. Piacenza, 1923).

295. *Pipless Italian Grapes*: "Passeretta" di Canelli (Province of Alessandria); and " Passolina " di Lipari, which is very similar to the Corinthian vine grown in Greece both have the defect of bearing small berries with thin skins. In the Rovasenda collection, at the School of Viticulture and Enology at Alba (Prov. of Cuneo), there is a vine called " Nouveau sans pepins ", with large bunches of fine grapes, but the bunches are too dense. This can however be remedied by topping and thinning the bunches. (A. SANNINO, *Rivista di Ampelografia*, year IV, No. 10, pp. 156-157. Alba, 1923). Fine, pipless grapes are borne by the hybrids Pirovano Nos. 75 and 76 obtained at Vaprio d'Adda (Prov. of Milan) by crossing Moscatellone with Sultanina bianca. Hybrid P. 75 is quite pipless and the berries are larger and more golden than those of Sultanina. The pulp is firm, the grapes have a fine muscat flavour ; the vine is very prolific and a free grower. Hybrid P. 76 which was put on the market in 1919, has much larger berries and all the merits of Moscatellone. Both ripen 12-15 days earlier than Sultanina bianca.

296. *Oil and Cattle cake from Tomato Seeds.* In Italy, the tomato-preservation industry supplies a large quantity of by-products, the most important of which is tomato seeds. These seeds furnish a drying-oil used in the manufacture of varnishes, and also for lighting. When purified, the oil can be used for food.

The cake resulting from the expression of oil is liked by cattle ; it is an excellent food and does not seem to affect the milk. It has the following composition : Water 10.10 % ; crude fat. 11.63 ; nitrogen free extract, 29.43 ; crude protein 38.13 ; digestive protein 23.75 %.

The cake may be given to stock alone, as mash, or with hay or straw. (*Revue Agricole de l'Afrique du Nord*, Year 21, No. 224, p. 741. Algiers, 1923).

297. **Brazil.** *Milk production from Sheep.* — A series of experiments made by Prof. G. SALERNO have demonstrated that the length of the lactation period is from 235 to 265 days ; the average yield about 18.9 litres per annum ; 100 litres of milk is estimated to supply 17.2 kg. of fresh cheese and 6.7 kg. of " ricotta " (cream cheese). As a general rule the sheep's milk is mixed with 25-30 % of goat's milk (A. ROMOLOTTI *L'Industria lattiera e zootecnica*, Year XXI, No. 12, Reggio Emilia, 1923).

298. " Jao " (*Crypturus noctivagus*) *a wild Gallinacea Capable of Domestication, found in Matto Grosso* (*Brazil*). — This bird is still common in the forests of Matto Grosso ; it is sometimes snared and allowed to run with hens ; in the breeding-season, but escapes, if not shut up. Although the matter has not been properly investigated, it appears that the " Jao " becomes quite domesticated after 4 or 5 generations. (*Chacaras e Quintaes*, Vol. 29, No. 1, pp. 19-20 Rio de Janeiro, 1924).

299. **France.** *Dibrachys Boncheanus, Useful parasite* : — M. MAMELLE describes this small entomophagous hymenopteron of which the female lays its eggs within the cocoons of *Galleria mellonella*. The larvae that hatch out from thes eggs parasitise and kill th caterpillars. (*L'Apiculture*, year 67, No. 10, p. 295, Paris, 1923).

300. *Film of the Best French Vineyards.* — The French Commission for the Export of Wines has had a picturesque and descriptive film made showing the most important vine-growing regions of France. — Anjou — Alsatia — Bordeaux — Burgundy — Banks of the Rhone — and Champagne. The film will be shown in 200 cinematographs in France and subsequently in 30 foreign countries.

301. *Timber Preservation.* M. R. CHAVASTELON (*Comptes Rendus de l'Académie des Sciences*, Vol. 176, No. 17, p. 178) advises the application of a solution of dichromate of copper made by mixing in a vessel (not composed of metal) a warm 6 % solution of potassium, or sodium, dichromate and upper sulphate. This solution can either be brushed over, or sprayed upon, the wood. During the 12 years it has been tested, excellent results have been obtained in the case of hard and of soft woods exposed to the weather and kept under the most different conditions. The copper dichromate which impregnates the green, or seasoned timber becomes transformed (after having destroyed by a process of oxidation, all bacteria, moulds or spores), into basic copper sulphate which closes all the orifices thus insuring a lasting reserve of chromic acid and of copper oxide by their progressive dissociation into increasingly basic chromates. If before the dichromate is applied, a solution of glue is brushed over the timber the preservation of the latter is still better assured.

302. **Italy.** — *A Cheap Insecticide Reported by Dr.* CIFERRI (*Gesta Azzarra agricola [Roma]*) is made from a decoction of the roots of *Bryonia dioica*, a very common Cucurbitacea. Many agriculturists in the neighbourhood of Alba (Prov. of Cuneo,) use it, at the right season, for the destruction of aphides, and CIFERRI has proved by experiment that it destroys these pests quickly and surely. The toxic effect appears to be due to the bryony, the roots of which plant contain 1.5 to 2 % of water-soluble alkaloid.

303. **South Africa.** *Locusts.* — The locust question is causing anxiety in the Potchefstroom district, although the farmers throughout the area are doing their best to fight the insects. Over 2000 swarms have been accounted for on 73 farms, of which 1099 have been destroyed in the Wolverhoek district. Concern is felt regarding the invasion of flying locusts from south-west Africa where it is feared that the measures taken are inadequate to deal with the enormous task of destruction. (*Farmer's Weekly*, Vol. XXVI, No. 664, November, 1924).

304. *Farm Accountancy.* — A. SIBILLE in a simple treatise on farm accountancy (Journal, Grand-Livre d'inventaire et des résultats) gives practical suggestions and data relative to each individual crop yield. The second part deals with appropriate methods of administration on a large scale. (*Les Comptes à la ferme. Comment je tenais mes comptes*, pp. 1-185. *Librairie agricole de la Maison Rustique*, Paris, 1923).

ALFREDO RUGGERI, *gerente responsabile*.

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Note. — The Bureau assumes no responsibility with regard to the opinions and the results of experiments outlined in this *Review*.

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ORIGINAL ARTICLES

THE ORGANIZATION OF AGRICULTURAL METEOROLOGY (AGRICULTURAL ECOLOGY) IN GERMANY.

The connection of meteorology and climatology with agriculture has been recognised from remotest antiquity ; further, that the weather affects the results of farming, agriculture and stock-keeping is very well known and the need has always been felt of finding some explanation of the correlation not only in the interest of individual agriculturists, but also in order that this knowledge may be employed for the purpose of insuring to the world at large a more certain supply of the produce of the land. Whenever the opportunity presented itself, as for instance, in 1878 at Cassel, and in 1900 at Hamburg, where interested persons were asked to give their opinions, they insistently and unanimously expressed their desire to explain and turn to account the above-mentioned relations, but until recently, the path to be followed could not be agreed upon. The question could only be adequately handled by the professional meteorologists, who however, were engaged in establishing the first principles of their own science, while meteorology was an unknown field both to the practical and the scientific agriculturist. Lack of meteorological knowledge then, as until quite recently, obscured the view, even of the circle of persons most directly interested. A prominent position was occupied in all these discussions by weather forecasting, this being the only means by which meteorologists believed they could render useful service to agriculture just as they assisted the sailor by timely warnings of an imminent storm. The possibility of short-time weather forecasting had been discovered but even when the

prophecies were correct, they did not sufficiently prove the utility of meteorology to agriculture nor satisfy the continual need, to a certain extent an elementary one, of forecasts that prophesied the weather longer in advance telling the agriculturist what to expect many days, or possibly, several months beforehand, or even during a considerable part of the agricultural year. The ordinary forecasts for one day are by no means useless to the farmer who, provided the information is reliable, can often avoid disappointment and injury by following the advice of the meteorologist. Such short notice can, however, only affect a few important questions and usually only applies to the work of the day on average-sized farms where as it is of no use in larger undertakings which require decisions as to the operations of a whole year. For these, long term weather-forecasting, if feasible, would be of incalculable advantage. Owing to the importance of the matter, very large prizes have long been offered in the United States of North America, to anyone succeeding in prophesying the weather correctly for a whole year. Several unprofessional persons in Germany have turned their attention to this problem (Rud. Falb, Andreas Voss, in Berlin and Landgerichtsrat Hinselmann at Hildesheim) and have gained for themselves a by no means small following, which clearly proves how great is the need. Unfortunately, these amateur meteorologists deal with more or less correct ideas in an inaccurate and unscientific manner, so that new unavoidable errors necessarily arise. Further, the statements of the results obtained are often subjective and untrustworthy. To avoid such errors is the main issue and here it is necessary for agriculture in general, and agricultural meteorology in particular to work together with pure meteorology. It is quite impossible for the former branches of science to be independent of the latter.

Agriculture must indicate the direction the work is to take and state the object to be attained, while pure meteorology, on its side, must use the means at its disposal and attack the difficult problem of long-term weather-forecasting. The co-operation of the pure meteorologist is necessary to agriculture in order to guarantee the correctness of the observations which render it possible to know the climate and form an opinion on crop conditions and growth.

The importance and the direct practical utility of regularly recording temperature, rainfall, overcast weather, the direction and force of winds, and possibly atmospheric moisture, have already

been demonstrated and will be recognised by continually increasing circles of agriculturists.

There, however, still remain difficulties connected will the right installation and use of the apparatus, the correct estimation and interpretation of the results obtained which need further scientific and technical research, while a revision of aim in accordance with the requirements of the agriculturists is often necessary.

In addition to forecasting the weather, agricultural meteorology has also the important task of making and working up observations explaining already existing phenomena. A knowledge of the climate makes it possible to foretell the weather to a certain extent. The averages that have been observed give a range of variation that afford useful assistance in deciding the direction of extensive agricultural operations. Whether sugar-beets, maize, lucerne, or more productive but less robust varieties of wheat should be cultivated can only be known by reference to the weather records. This work, however, belongs to the narrower field of agricultural meteorology which has already been touched upon, and even more or less exhaustively treated, in connection with agriculture, horticulture and stock-breeding, although its importance has never been sufficiently recognised and brought forward, indeed as compared with soil science, agricultural meteorology, although strictly speaking of paramount importance has always been treated as a matter of secondary interest.

Many small and even large and far-reaching mistakes and disappointments have been due to inadequate knowledge of climatic conditions. In all agricultural and field experiments, in the agricultural researches which are recognised to be of ever increasing importance, knowledge of the climatic factors is of especial moment and may be regarded as indispensable. Here, as we have already stated, pure meteorology is required in order to insure the accuracy of the data recorded.

Phenological observation is a great help to knowledge of climate, especially from the agricultural standpoint, for by this means, a record is kept of the different phases and growth stages of plant development.

The course of vegetation registers faithfully the sum of the results produced by the weather factors and is a more trustworthy evidence than even meteorological observation. The connection

between plant development and weather has not yet been rendered completely clear, but phenology has done signal service in establishing the characters of the average climate and the weather conditions of a single year. The founders of this science, in the first place, Hoffmann (Giessen) and later G. Drude (Dresden) and Ihne (Darmstadt) began by regarding the plants selected for observation from the botanical standpoint, but afterwards they added rye, fruit-trees and vines, etc., to their list, and studied these from the point of view of the agriculturist and the horticulturist. The " Biologische Reichanstalt für Land- und Forstwirtschaft " has lately started an extensive phenological service directed chiefly to the observation of agricultural and farm crops, garden plants and fruit-trees, special attention being given to plant-diseases whether caused by fungi, or animals. It is not to be expected that all the observation Stations will send answers to the large number of questions submitted to them, but if they supply only a certain amount of information on the different heads, the data can be worked up with useful results at the Central Station. Therefore, the observer must not be alarmed at the length of the questionnaire he receives. A few accurate, careful answers are of much more value than a number of unreliable statements. If the undertaking succeeds fairly well a great deal of material will be collected that will not only prove very useful for scientific and practical work, but will also afford results beneficial to the world at large.

The following is a list of the subjects falling within the scope of agricultural meteorology. They are not arranged in any special order.

In the first place come :

1. Long-term weather-forecasting. Prophecies for term of agricultural operations.

How far weather conditions affect :

2. True and false mildew ;
3. Rust-fungi ;
4. Smut-fungi ;
5. Aphides ;
6. Spread of wheat varieties resistant and non-resistant to cold ;
7. Range of maize cultivation for grain ;
8. Limits of lucerne cultivation ;
9. Conditions of clover and lucerne cultivation ;

10. Conditions of grass-seed cultivation ;
11. Rotation in the case of cereals, special kinds of oat and potatoes ;
12. Sugar content of beets ;
13. Quality of tobacco ;
14. » » wines ;
15. » » hops ;
16. » » flax ;
17. Cultivation of aromatic plants, carraways, fennel, peppermint;
18. Cultivation of poppies for seed, oil, or opium ;
19. Albumen and starch content of wheats ;
20. Albumen and starch content of barleys ;
21. Oil content of, colza and flax ;
22. Quality of mustard ;
23. Fungus diseases of peas especially *Ascochyta* ;
24. Fungus diseases of lupins ;
25. Determination of date of sowing, especially of cereals, beets, potatoes.

The number of these items could well be enlarged.

The satisfactory answering of these questions would do much to increase and insure agricultural crop returns. If once the factors influencing plant growth were determined, it would be possible in most cases to strengthen the favourable influences and to prevent, or mitigate the injury caused by untoward conditions. This is the real way in which meteorology can help agriculture which is indebted to pure meteorology and phenology for the discovery of first principles and the collection of much valuable material.

It is the work of agricultural science to give the impetus to important research and to collect and distribute the material obtained, as by no other agency could scientific and agricultural principles be sufficiently combined. Meteorology by itself could not deal with the agricultural side of the above-mentioned questions neither could it cope with them from the botanical, zoological, biological or chemical standpoint. Agricultural Meteorology is a branch of agricultural science which, like the latter, is in need of several ancillary sciences. These forfeit nothing of their importance, on the contrary, their utility and field of work is enlarged, although the application of their discoveries to practical agriculture lies outside their province.

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As a result of the resolutions passed by the International Institute of Agriculture in Rome, a Sub-Committee has been appointed by the Reichs Ministry of Food and Agriculture for the purpose of promoting the interests of Agricultural Meteorology. In this Sub-Committee, pure Meteorology, the " Biologische Reichsanstalt für Land-and Forstwirtschaft „ (Reich's Biological Institute for Agriculture and Forestry), the " Landes anstalten für Gewässerkunde " and the " Landwirtschaftswissenschaft " (Institutes of Hydraulics and of Agricultural Science) are represented. The following points were discussed :

1) The creation of a Central Institute for work connected with Agricultural Meteorology is not advisable. In future, this work is to be decentralised and entrusted to the Institutes of Agriculture and Science connected with the Universities and High Schools, the " Biologische Reichsanstalt für Land-und Forstwirtschaft " (Reich's Biological Institute for Agriculture and Forestry), the Forestry Schools, the Gardening High Schools, the Meteorological Institutes and the Hydrological Institutes.

The assistance of the Statistical Departments is much desired.

2) The mapping of the territory from the standpoint of agricultural meteorology is to be extended.

3) The " Biologische Reichsanstalt für Land- und Forstwirtschaft " has undertaken to collect and work up data referring to agricultural phenology with the object of rendering statistics a more useful and reliable basis upon which to foretell crop yield.

4) It is always being more fully recognised that the most important contribution that pure meteorology can make to agricultural meteorology consists in predicting the weather for longer periods in advance. It is not so much a question of a detailed forecast as of giving the broad outlines of the kind of weather to be expected.

5) The " Landesanstalt für Gewässerkunde " (Hydraulics Institute) is devoting its attention chiefly to the question of evaporation which, as is well-known, is a matter of great importance to the life-functions of agricultural crops and domestic animals.

Respecting the wish expressed that suggestions should be made to the International Institute of Agriculture as to the most appropriate means of collecting data referring to the various growth stages

of the different agricultural crop plants and the yields obtained, as well as information concerning the meteorological conditions prevailing during the period of development, we may state that all this work comes within the special sphere of the " Biologischen Reichsanstalt " assisted by the Stations for Reporting Plant Diseases. It is however advisable that this annual report should (after its discussion by the Commission of Agricultural Meteorology) be forewarded by the Reichs Minister for Food and Agriculture (Reichsminister für Ernährung und Landwirtschaft) to the International Institute of Agriculture.

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THE IMPORTANCE OF SOIL MAPS FOR AGRICULTURE.

The beginning of geological map-making dates back to the eighteenth century. Already at that time, an attempt was made to produce general maps of separate countries which could naturally give no detailed information. Later, the small scale of 1 : 100 000 was adopted and maps of this scale, although they were still of a general character could lay greater claim to accuracy and were readily used in mining, land improvement, and industry. The making of these new maps was the chief task of the Local Geological Institutes founded in the eighteenth century. The Governments of all the civilised States especially of North America, Great Britain and France, as well as of those countries which like Japan, have recently adopted Western methods, fully realised the benefits accruing to agriculture from geological map-making, and hence readily gave financial support to this branch of scientific work. Although Germany was not able entirely to keep pace in this new movement, geological local Institutes were, however, created in certain States viz., first in Prussia and Saxony, and subsequently in Strasburg (1873), Darmstadt (1882), in Baden (1889) and in Würtemberg (1903). Of the 8 Local Geological Institutes of Germany, that of Bavaria occupied itself most in making maps to the scale of 1 : 100 000. About $^2/_3$ of the Kingdom were mapped on this scale and the work continued until the nineteenth century. It was, however, not until 1909, that Bavaria followed the example of the other Allied German States and adopted a scale of 1 : 25 000 for its maps though Prussia and Saxony had taken the step 70 years previously. Saxony has mapped all its territory on this scale, while Prussia has so far published well over one thousand geological maps drawn to the scale of 1 : 25 000 and representing $^1/_3$ of the surface of that kingdom.

The adoption of the relatively large scale of 1 : 25 000 by nearly all the civilised States was due to the increasing conviction that such maps would be of much greater use in practical agriculture,

forestry and land improvement than the 1 : 100 000 maps which could convey but little of the information required.

We must now describe more in detail the historical development of geological map-making in different countries. A very good summary of this work is given by W. KÖHNE in his article " Die Entwicklungsgeschichte der geologischen Landesaufnahme in Deutschland " published in the *Geologischer Rundschau*, Vol. VI, Part. 3 (See also the works of M. FESCA A. JENTZSCH and other authors on the same subject).

A geological map drawn to the scale of 1 : 25 000 gives a fairly accurate idea of the geology of the district mapped, but can only represent in a general manner the relations of the soil and the subsoil which have been discovered by hundreds of hand borings. On the margin of the sheets of these maps are explanations of the colours and symbols as well as reproductions of all the chief sections. On the lower margin, are sections across the map showing the position of the different strata. The various geological formations are represented by characteristic colours, but as far as possible, everything has been done to avoid interfering with the general survey.

Such a map can naturally only give the broad outlines of the district with its villages, network of roads and its water-courses. Places of similar altitude are connected by contour-lines which give an idea of the nature of the ground. The sections at the side of the map show the super-imposed strata and their thickness, while the chief character of the soil is denoted by arbitrary symbols; dots representing sand, circles gravel, oblique shading clay, etc. It is not always easy to represent detritus or the succession of many strata, but the detailed geological maps of Würtemberg and Bavaria show how these problems may be solved without sacrificing clarity to any appreciable extent. From this point of view a comparison should be drawn between the maps made by A. SAUER to illustrate the paper written by A. ZENTZSCH: " Die geologische Karte vor dem deutschen Landwirtschaftsrat ", *Internationale Mitteilungen für Bodenkunde*, 1912, Part 1, pp. 29-32 and W. KÖHNE's article, " Practische Erfahrungen bei geologisch-bodenkundlichen Kartierungsarbeiten in südlichen Bayern " *Internationale Mitteilungen für Bodenkunde*, 1912, Part 5, pp. 6 and 7.

The great difficulty in the case of the 1: 25 000 geological maps which are often called detailed geological maps, or geological-agro-

nomical maps, is how best to explain the map in the accompanying text. In the so-called explanatory appendix, all the geological climatic and agricultural particulars are set forth with as much detail as possible, but unfortunately, the agricultural information leaves much to be desired. In Bavaria, however, where the agriculturist and the soil-scientist have collaborated in working out the details, the facts of most importance to agriculture, farming and forestry have been gone into more fully. Much attention has also been paid in general to the investigation of the characteristic types of soil and these data have been supplemented with exhaustive observations respecting the chemical and physical properties of the soils which might serve as a good basis for the scientific-practical determination of the soil conditions.

Even if it must be conceded that the geological detailed maps drawn to the scale of 1 : 25 000 are only able to furnish the agriculturist and the forester with general principles for the working of the soil and therefore occasion a certain amount of dissatisfaction in those whom they profess to serve, the fault lies in the first instance in the selection of too small a scale for a map intended to represent all the factors important to agriculture and to forestry. We must not forget that in a map made on the scale of 1 : 100 000, one hundred hectares go to 1 sq. centimetre, while in a 1 : 25 000 map, about 1.25 hectares go to 1 sq. centimetre, and in a 1 : 5000 map, only 0.25 hectares go to 1 sq. centimetre. Therefore RAMANN has very truly remarked that on the 1 : 100 000 map, any changes involving about 100 hectares can clearly be shown, while in the 1:25 000 and the 1:5000 maps respectively, the alterations in areas of about 5-6 hectare and $^1/_3$ hectare respectively could be represented. It is, however, undoubtedly the case that maps drawn to the scale of 1 : 25 000 can provide the agriculturist and forester as well as the land-improver with important information that would form a basis for better soil-cultivation and for soil-improvement. They show the condition of the soil, the nature of the subsoil, the underground water supply and their connection with the formation and conformation of the ground, thus affording a valuable index of the kind of crop and fruits to grow. These data are also of paramount importance for the determination of crop distribution and rotation, as well as being a useful guide in carrying out farming and improvement schemes. These maps in many cases render it possible to estimate the value of the results

obtained from cultivation and manurial experiments and show the cultural operations necessary and also the implements and amount of work required to carry them out.

The vegetation and growth periods depend not only upon climate and the texture of the soil, but also upon subterranean conditions. Thus, it is well known that a heavy soil where the growth period is short, is especially suited to woods, or pastures, particularly when the weather conditions are bad, whereas the soil can be worked and prepared best under the most varied atmospheric conditions.

A knowledge of the chief types of soil enables the agriculturalist to decide whether his land as a whole requires dung, or green-manure, or whether the best results are to be expected by the application of chemical fertilisers. For in this connection, the nutrient content of the soil and its absorptive power, as well as the subterranean and climatic conditions are all factors of first importance. That seeding and crop-yield, cultural operations and harvest, all depend upon soil and climatic conditions does not need any proof.

Not infrequently, substances important for agricultural purposes are found in the more deeply seated layers. This is especially the case as regards different gravels, clays, lime, marls, etc., while often the soil itself is of a texture to be used in the manufacture of pottery, bricks etc.

Great stress must, however, be laid upon the fact that only the general principles of the cultural operations to be performed can be learnt from maps made to the scale of 1 : 25 000 and that care must be taken not to draw too definite conclusions from the data they give. Situation and climate, the factors chiefly influencing tillage and harvest, are shown to some extent, even if a map of the scale of 1 : 25 000 is not large enough to express all their variations, any more than a map drawn to the scale of 1 : 25 000 can give as good an idea of the different soil conditions as a soil-map of which the scale is 1 : 5000.

The detailed geological maps are very useful to anyone wishing to learn quickly the soil conditions and geology of a special district. They should always be in the hand of the Agricultural Adviser, and of persons engaged in land-improvement and the rectification of holdings while the tax-assessor would often obtain from them useful data upon which to base the value of the land. These maps have proved of good service in buying and selling operations, as well as in renting and mortgaging, although here, as in other cases, the

1 : 5000 maps, of which we will now speak more at length, would prove still more useful (1).

The larger scale of these detailed soil-maps which need not be limited to 1 : 5000, but may even be extended to 1 : 2500, or even 1 : 1000, naturally allows of information being recorded upon them which is quite outside the scope of an ordinary geological map. Thus, while a detailed geological map deals with an area of some 800 hectares, one of these large scaled maps (1 : 5000) represents a surface of 500 hectares. Therefore this latter type of map can show all the soil conditions much more clearly and thoroughly than any ordinary geological map which, from the agricultural point of view, can only be a more or less general map. The expense involved in making the larger scaled map is of course correspondingly higher, as it involves the investigation of the soil as well as merely surveying the ground. Such a work cannot be systematically carried out over the territory of an entire State. In the case of Bavaria alone, such a map would employ 2 generations of 100 geologists. On the other hand, practical agriculturists should be strongly urged to have such maps made on their own initiative and at their own expense. Speaking generally, such maps would be of special use in the following cases :

1) For large estates where it is wished to obtain an accurate knowledge of the land in order to cultivate as systematically as possible ;

2) For fields where cultural and manurial experiments are to be carried out according to a given plan ;

3) For the land and experiment fields belonging to Agricultural Schools and Institutes ;

4) For land-improvement experts and Commissions appointed for the rectification of holdings ;

5) For Communes wishing to improve their land thoroughly.

It would be very advantageous for these soil-maps to be prepared of districts which have already been geologically mapped, because the soil conditions are very complicated and variable, so that they cannot be shown on a small-scale map. In such cases, the geological map makes an excellent foundation, while the " Bodenkarte " supplements and extends the data thus obtained.

(1) Cfr. " Mémoires sur la cartographie des sols dans les pays ", Edition published by the Geological Institute of Rumania, Bukarest.

All States have made attempts to provide the practical agriculturist with this type of map. We need only recall to mind in this connection, the names of ORT, HAZARD, FESCA, KOPECKY, HEINRICH, etc. Unfortunately, hitherto no uniform method for making soil-maps has yet been agreed upon. The systems adopted have been many, but we have no room to describe them here. Even in Germany itself, no attempt has been made to attain uniformity of representation. It is being increasingly realised that it is best to possess a considerable number of these maps.

Many decades ago, soil maps were made in Mittelfranken by the students of OEBBECKE and LENK, while in Unterfranken, similar work was done by some students of Geheimrat KRAUS. The Agricultural Soil Map of the Gelschsheim estate in Upper Bavaria was next made as a preliminary attempt by some of the officers of the Bavarian "Geologischen Landsuntersuchung" (Geological Survey). Maps were also made of the Häusern estate and the State property of Weihenstephan. We must also mention the excellent work of the former Director of the Bavarian "Moorkulturanstalt" (Moor-Reclaiming Institute), A. BAUMANN, who mapped the Nuremberg Reichswald, the Bamberg Hauptmoorwald and the Chiemsemoor.

Of recent years, the local Geological Institutes have made it their special work to produce soil-maps and investigations at the request and the cost of the owners of the estates surveyed.

In order to obtain uniformity of representation, the author, while still an officer of the Geological Survey, made various suggestions that were ultimately adopted and met with approval in agricultural circles. The great object in making this type of map is to introduce all the data required by the agriculturist without sacrificing clearness and legibility. No geological data are introduced on the soil map.

The facts of chief interest to the agriculturist are expressed by means of different colours and symbols. Thus, clay is coloured violet, marl brown, sand yellow, calcareous soil blue, and humus dark grey. The other types of soils, or facies, such as clayey, marly, sandy, etc. were represented by shading, perpendicular lines being used for clayey soil, and oblique lines for marly soil. Sandy soil was represented by dots and gravel by circles.

The subsoil was only marked on these maps when it could be drilled to a depth of 1 m., for beyond this point its interest for the

agriculturist diminished with the depth. If it was necessary to depict the condition of the deep-seated layers this was done, in a very sparing manner, by means of colours and symbols so that, if we may be allowed the comparison, trenches seemed to have been cut in the map, thus revealing the deeper-seated strata. The thickness of the soil above the subsoil is given in red figures. The details required by the practical agriculturist are given by the sections on the margin of the map and the list printed in the explanatory text.

Maps of this description that were shown by the Bavarian Geological Survey at the Exhibition held by the German Agricultural Society ("Deutsche Landwirtschaftsgesellschaft") at Nuremberg in 1921, were very simple and easily understood, so that they found great favour with agriculturists.

A thorough examination of the characteristic soils was made in the laboratory which greatly increased the value of these soil-maps, for not only were the amount of nutritive substances and the absorption capacity of the soils estimated, but the physical properties of the soils were determined and their water, air and heat-retaining capacity were investigated. The estimation of the nutritive substances present has been greatly facilitated by the new methods lately discovered, amongst others NEUBAUER's method of determining the phosphoric acid and potash requirements of soils and methods for determining the soils need of lime. How far CHRISTENSEN's (Lyngby) biological method of estimating the phosphoric acid requirement of soils will actually prove a rapid and reliable process remains to be seen, but it is to be thoroughly tested at the Institute of Agricultural Chemistry belonging to the Weihenstephan "Hochschule." The great merit of the soil-map is the large scale to which it is drawn which permits of the results of a thorough investigation of the soil being clearly marked on it.

Geological detailed maps and soil-maps alike will afford valuable assistance in the future in spreading knowledge of the soil conditions and improving the present methods of working the land, if an attempt is made to bring the results of scientific investigations into agreement with practical experience, so that by taking into consideration all the other factors influencing crop production it may be possible to reach conclusions of general application to our chief types of soil. How this method can be evolved and applied is exhaustively explained by the author in his work "Neue Grund-

lagen und Wege zur Erhöhung der Bodenproduktion Deutschlands", *Internationale Mitteilungen für Bodenkunde*, 1917, Parts 1 and 2.

Scientific soil investigation and the results of experience may be combined by making enquiries from practical agriculturists and pacing the fields, the results being afterwards embodied in geological soil-maps. Every effort should also be made to collect and co-ordinate the data obtainable from officials whose work it has been to accumulate scientific material relating to the crops produced by the soils in question. We can only deal briefly with this question here.

The first fact to be ascertained from individual practical agriculturists is their experience of the characteristic soils from the points of view of the utilisation, working and manuring of the soil, the cultivation and yield of crops. Special attention should be paid to all these points when the observer is walking through the fields, especially at the different seasons and in very dry, or wet years, in order to see clearly how the soils in question react under natural conditions and obtain material for useful comparisons. The appearance of certain weeds, and of animal and plant parasites is in many ways closely connected with soil and climate.

The officials, who in the course of their duties, are able to collect material that will serve to increase our knowledge of soils are chiefly those engaged in rectifying holdings, reclaiming moorland, or employed in water-works offices, etc. Unfortunately, most of the data thus collected lie buried in documents and it would be a useful piece of work to collect and sort these records.

The land valuation which was carried out last century with the co-operation of practical agriculturists by means of borings, and section-cutting, as well as estimates, provided excellent, if not recent data showing how far the results of scientific soil investigation agree with practical experience. The author himself was able to see from about 25 000 estimates taken from land taxation plans upon which the geological and soil conditions were noted, that even in his own time, the valuers rightly recognised, at all events in the main, that the quality of the land depended on topographical, geological and climatic conditions. Compare also: A. Meitzen, "Der Boden und die landwirtschaftlichen Verhältnisse des preussischen Staates nach dem Gebietsumfang von 1866". Vols I-IV, Berlin, 1866, Verlag Parey, and Th. Wölfer: "Die geologische Spezialkarte und die landwirtschaftliche Bodennutzung" in their "Bedeutung

und Verwertung für Land und Staatswirtschaft", Vol. XVIII of the same *Landwirtschaftliche Jahrbücher*. Supplementary Vol. III. Further, it is an interesting fact that the prices of the various pieces of land coincided with their value as shown by scientific investigation of the soil.

It is always advisable, when map-making, to take statistical data as a basis if possible. Such material should be obtained easily when surveying property, but is not readily gleaned if the area has been mapped on the scale of 1 : 25 000.

In such a case, recourse should be had to the Statistics of the Commune; the cultivation and crop statistics being especially useful for this purpose as the author frequently found. Similar data can also be obtained from the sheets of the Bavarian 1 : 25 000 map.

The application of these principles has rendered it possible to represent soil cultivation in Bavaria as determined by the geological conditions obtaining in the Kingdom, while a wider application of the data drawn from the above-mentioned sources has served as a basis for a general map showing the areas covered by heavy and light soils in Bavaria.

It is greatly to be hoped that the present deficiencies in Agricultural Statistics will soon be remedied. The author has published his views on this subject on various occasions.

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HOW LONG DO THE VARIOUS SEED SPECIES RETAIN THEIR GERMINATION POWER?

Investigations made at the Danish State Seed Testing Station in 1891-1903-1920.

This question has often been asked by those engaged in seed testing work, but it has not been possible to give a generally binding answer to it. The ability of the seed to keep its germination power is dependant on many conditions which must be known in every single case if a fair reply is to be given to this question. The circumstances under which the seed is grown, its power of germination and water content just after the harvest, its state after eventual drying and cleaning, and the conditions of moisture and temperature in the store-rooms, are all factors which influence the germination power of the seed under storage.

The better the seed is grown and the better its germination power after the harvest, — it being besides, uninjured — the drier and cooler it is kept, the better does the seed keep its power of germination.

Even if all those conditions are equal, the ability of the various seed species to retain their germination power is very different. On page 42-46 in the Report of the Danish State Seed Testing Station for 1902-03 (special issue of "Tidsskrift for Landbrugets Planteavl" = Journal of Agricultural Plant Culture) a table shows how a series of seed samples of the common agricultural plants and some garden tree and weed species have kept their germination power during 10 years. The samples have been stored at the State Seed Testing Station at the usual room-temperature (about 18° C.), conditions being thus warmer and drier than those under which the seed is usually kept in the store-rooms in this country. Every autumn 300 seeds of each species have been placed to germinate until the seed had lost its germination power.

TABLE I-*a*

Year	*Trifolium pratense* G. p.* %	*Trifolium repens* G. p. %	*Trifolium hybridum* G. p. %	*Medicago lupulina* G. p. %	*Medicago sativa* G. p. %	*Anthyllis vulneraria* G. p. %	*Lotus corniculatus* G. p. %	*Trifolium incarnatum* G. p. %	*Onobrychis sativa* G. p. %	*Ornithopus sativus* G. p. %	*Phleum pratense* G. p. %	*Lolium perenne* G. p. %	*Lolium italicum* G. p. %	*Festuca pratensis* G. p. %	*Festuca ovina duriuscula* G. p. %	*Festuca arundinacea* G. p. %	*Bromus ariensis* G. p. %	*Bromus mollis* G. p. %	*Arena elatior* G. p. %	*Dactylis glomerata* G. p. %	*Alopecurus pratensis* G. p. %	*Agrostis alba* G. p. %
1 Year	97 + 3	85 + 15	83 + 16	91 + 8	91 + 8	3 75 + 18	98 + 0	56 + 4	96 + 1	98	92	83	98	98	89	95	95	73	98	90	89	91
2 Year	99 + 1	97 + 3	81 + 18	88 + 4	91 + 7	1 81 + 14	95 + 1	45 + 1	90 + 2	94	89	79	94	96	84	93	96	65	94	84	84	96
3 Year	99 + 1	96 + 3	79 + 18	93 + 3	89 + 3	2 73 + 13	90 + 0	28 + 9	92 + 3	96	89	79	96	93	70	82	93	58	88	64	64	93
4 Year	96 + 4	94 + 5	77 + 19	84 + 3	84 + 3	3 67 + 9	41 + 0	11 + 0	81 + 2	91	87	65	81	75	54	61	82	38	83	56	56	92
5 Year	98 + 2	94 + 6	78 + 17	79 + 3	88 + 3	1 40 + 11	10 + 0	2 + 0	83 + 1	79	67	57	82	40	54	8	61	8	50	38	38	92
6 Year	98 + 2	94 + 6	79 + 17	80 + 3	84 + 3	1 37 + 17	10 + 0	1 + 0	64 + 3	53	41	40	81	14	14	8	8	0	16	10	10	89
7 Year	98 + 2	95 + 5	82 + 16	91 + 3	91 + 3	1 37 + 13	13 + 10	0 + 0	54 + 3	12	24	22	79	6	1	0	0	0	6	1	4	59
8 Year	98 + 2	96 + 4	83 + 16	91 + 3	91 + 3	1 40 + 12	7 + 7	0 + 0	45 + 3	4	10	15	65	2	0	0	0	0	0	0	0	44
9 Year	97 + 3	95 + 5	83 + 16	91 + 8	91 + 8	3 75 + 18	98 + 0	56 + 4	96 + 1	98	92	83	98	98	89	95	95	73	98	90	89	91
10 Year	97 + 3	85 + 15	83 + 16	91 + 8	91 + 8	3 75 + 18	98 + 0	56 + 4	96 + 1	98	92	83	98	98	89	95	95	73	98	90	89	91

G. p. = germination power.

TABLE 1-*b*.

	Poa trivialis	*Poa pratensis*	*Poa nemoralis*	*Holcus lanatus*	*Cynosurus cristatus*	*Phalaris arundinacea*	*Phalaris canariensis*	*Avena sativa*	*Hordeum* sp.	*Triticum vulgare*	*Secale cereale*	*Beta vulgaris*	*Brassica napus rapifera*	*Brassica campestris rapifera*	*Daucus carota*	*Pisum* sp.	*Lupinus luteus*	*Sinapis alba*	*Spergula maxima*	*Spergula sativa*	*Linum usitatissimum*	*Raphanus sativus radicula*
	G. p.* %	G. p. %	G. p. %	G. p. %	G. p. %	G. p. %	G. p. %	G. p. %	G. p. %	G. p. %	G. p. %	G. p. %	G. p. %	G. p. %	G. p. %	G. p. %	G. p. %	G. p. %	G. p. %	G. p. %	G. p. %	G. p. %
1. Year . .	98	** 78	84	86	63	49	99	84	100	92	93	84	98	98	77	87	85	96	83	86	72	71
2. Year . .	98	94	77	87	53	29	97	71	100	95	88	90	97	97	69	—	80	96	83	87	69	—
3. Year . .	95	87	57	84	33	20	96	81	97	87	65	88	98	99	65	90	—	95	80	81	68	55
4. Year . .	94	85	27	76	13	2	93	75	90	88	20	86	95	99	53	94	54	91	64	74	50	53
5. Year . .	78	72	8	57	5	0	97	59	42	74	3	92	98	96	39	90	52	92	70	76	38	44
6. Year . .	40	44	2	42	0	—	87	58	5	78	0	76	94	93	21	87	27	87	58	73	31	39
7. Year . .	9	32	0	31	—	—	87	56	0	24	—	72	92	77	14	86	5	90	51	62	13	26
8. Year . .	0	12	—	14	—	—	82	54	—	3	—	67	84	67	6	83	10	85	40	49	12	18
9. Year . .	—	10	—	1	—	—	68	47	—	0	—	65	79	53	0.3	57	10	85	43	49	5	18
10. Year . .	—	1	—	1	—	—	51	32	—	—	—	53	66	53	0	47	0	76	24	36	6	5
11. Year . .	—	0	—	0	—	—	53	2	—	—	—	39	31	29	—	7	—	72	18	23	1	3
12. Year . .	—	—	—	—	—	—	37	0	—	—	—	6	7	12	—	0	—	49	7	12	0	1
13. Year . .	—	—	—	—	—	—	22	—	—	—	—	7	1	3	—	—	—	36	4	8	—	—
14. Year . .	—	—	—	—	—	—	17	—	—	—	—	1	1	0.3	—	—	—	24	2	3	—	—
15. Year . .	—	—	—	—	—	—	13	—	—	—	—	0	0	—	—	—	—	9	0	1	—	—
16. Year . .	—	—	—	—	—	—	3	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—

*) G. p. = germination power.

**) The sample was probably not germinating-ripe the 1st year.

TABLE I c.

	Brassica oleracea quercifolia		*Brassica oleracea capitata alba*		*Carum Carvi*		*Pastinaca sativa*		*Allium graveolens*		*Petroselinum sativum*		*Thymus* sp.		*Salvia officinalis*		*Reseda odorata*		*Chrysanthemum coronarium*		*Abies balsamea*		*Picea excelsa*		*Picea alba*		*Pinus sylvestris*		*Pinus montana*		*Pinus austriaca*		*Larix* sp.	
	G. p.	%	G. p.	%	G. p.	%	G. p.	%	G. p.	%	G. p.	%	G. p.	%	G. p.	%	G. p.	%	G. p.	%	G. p.	%	G. p.	%	G. p.	%	G. p.	%	G. p.	%	G. p.	%	G. p.	%
1. Year . .	92		94		77		92		67		65		62		74		59		48		29		83		87		69		96		66		32	
2. Year . .	—		—		60		—		78		—		—		82		66		46		20		71		69		86		66		18	
3. Year . .	85		94		13		73		70		48		26		73		48		50		13		56		56		83		58		15	
4. Year . .	86		82		0		41		54		30		18		54		53		47		8		44		32		70		42		4	
5. Year . .	90		85		—		3		50		20		9		57		33		46		3		28		16		53		25		0	
6. Year . .	85		85		—		0		20		18		3		22		39		43		2		11		6		42		13		—	
7. Year . .	71		48		—		—		12		3		0		6		39		27		0		10		0		47		1		—	
8. Year . .	51		6		—		—		1		—		—		3		19		17		—		3		0		28		3		—	
9. Year . .	31		11		—		—		0		—		—		0		6		4		—		2		—		23		2		—	
10. Year . .	18		0		—		—		—		—		—		—		2		1		—		0		—		19		0		—	
11. Year . .	0		—		—		—		—		—		—		—		2		1		—		—		—		11		—		—	
12. Year . .	—		—		—		—		—		—		—		—		0		—		—		—		—		5		—		—	
13. Year . .	—		—		—		—		—		—		—		—		—		—		—		—		—		1		—		—	
14. Year . .	—		—		—		—		—		—		—		—		—		—		—		—		—		1		—		—	
15. Year . .	—		—		—		—		—		—		—		—		—		—		—		—		—		0		—		—	
16. Year . .	—		—		—		—		—		—		—		—		—		—		—		—		—		—		—		—	
17. Year . .	—		—		—		—		—		—		—		—		—		—		—		—		—		—		—		—	
18. Year . .	—		—		—		—		—		—		—		—		—		—		—		—		—		—		—		—	

G. p. = Germination power

In the above tables is stated to what extent the samples of the 61 seed species tested have kept their germination power during the many years the investigation has lasted. As the table shows, only one sample of each species is tested. In order to be able to judge anything with regard to the ability of the various species to retain their germinating power, a considerably greater number of every species must be examined. This has been done in the investigations of seed of our most important agricultural plants; these investigations were established in 1902-03; they are mentioned below. As it appears from the tables, 1-*a-b-c* and 2-*a-b-c-d* the results of the two series of examinations agree very well. The single results of the last examinations (table 2-*a-b-c-d*) will be treated later in this report, therefore only the main characteristics of the first tests (table 1-*a-b-c*) will be recorded here.

The seeds of the *legumes* which had to begin with a good germination power have still in the 3rd year of their life kept this almost unaltered. During the following years the germination power decreased while the content of hard seeds in most cases was almost constant. Of some of the samples, *Trifolium repens*, *Trifolium hybridum* and *Lotus corniculatus* for instance, a few seeds still germinate after 25 years have elapsed, and the samples contain some hard seeds.

Also those *grass seed species* that had at first a high power of germination have kept this nearly unaltered in the 3 years. An exception to this is, however, the samples of *Bromus arvensis*, *Alopecurus pratensis* and *Secale cereale*. Only a few of the grass species keep their germination power more than 7 to 8 years. The sample tested of *Avena sativa* showed in the first test a considerably lower germination power than normally (about 97 %). Nevertheless this keeps the power of germination longer than the samples of the three other species of the cereals which had at the beginning a higher germination power than the sample of *Avena sativa*. An examination of another sample of *Avena sativa*, unfortunately carried on only for 7 years — has proved that this species retains the germination power very well; the sample germinated 97 % the first year and the 7th year 87 %.

With regard to the root seed, the samples of *Beta vulgaris*, *Brassica napus rapifera* and *Brassica campestri rapifera* have kept their power of germination almost unaltered until the 9th year, after which a decrease in the germination power has taken place.

All the samples in question do, however, even in the 10th year germinate more than 50 %. The seed of *Daucus carota* has already the 2nd year decreased the germination power somewhat. An equal reduction takes place thereafter annually, and the 9th year the seed is dead.

The seed of *Cruciferous* plants seem to keep the germination power comparatively long, while those of the *Umbelliferous* decrease more rapidly their power of germination.

The seed of Conferae has even in the 2nd year a lower germination power than the 1st year and this decreases equally year by year. The samples of *Pinus silvestris* and *Pinus montana* contain, however, the 14th year still a few seeds able to germinate.

The results recorded in table I-*a-b-c* refer only as mentioned to a single sample of each species. As the ability of the seed consignments to keep their germination power can vary considerably, a new series of investigations in which more samples were used of the important species, was established in 1902-03. As to these samples mention should be made of the following.

With the exception of a few samples of *Beta vulgaris*, all the samples have been sent in for testing at the State Seed Testing Station in the season 1902-03, but nothing definitely is known about them with regard to the conditions under which, and when, they were grown. In all probability most of the samples were harvested in the autumn 1902 ; some of those with a comparatively low power of germination are perhaps of earlier crop or a mixture of old and new seed.

Before mentioning the various results of the investigations, it should be pointed out that the "1st year " in the table means with the exception of a few samples of *Beta vulgaris*, the year in which the samples have been tested the first time ; " 2nd year " is the autumn after the season on which the seed was sent in and so on. In most cases one year has not elapsed between the first and the second test. The latter is for those species harvested in the autumn 1902 and the test made in the beginning of the 2nd year after the harvest. The third examination has been made in the beginning of the 3rd year and so on.

The 1st test of the sample was made at different seasons viz. when the samples have been received at the State Seed Testing Station. They have thereafter been stored in drawers in a place at usual

room temperature (about 18°C) all the year round. All the seed species concerned, except the beets, have been placed to germinate every year in September-October on the JACOBSEN tank. This apparatus is composed of a zinc container (1 m. × 2 m. in size, and able to contain 300 × 100 seeds) filled with water.

About 7 cm. (2-3 inches) above the surface of the water, zinc plates perforated in strips are placed and on these plates circular woollen mats, from which a wick goes down into the water. On top of each woollen mat is a crocheted one, on top of that again one of filter paper about 7 cm. in diameter. On this 100 seeds are so placed by means of a pincette that they cannot touch each other. This is to prevent eventual disease spreading from one seed to the other. The whole is covered by a glass bell with a hole in the top to permit the carbonic acid generated by germination to escape in the current of the air caused by the higher temperature of the water. The germinator is heated by means of one or two electric warmers placed in a drawer underneath. The beet seeds are packed in grey filter paper and placed in large glasses (about 10 cm. = 4 inches high and 9 cm. = 3 ½ inches in diameter) in water in a thermostat.

Sample No. 1 *Trifolium pratense* was tested the first time in January 1903. It was taken from large consignements delivered to farmers. As the sample contains so few hard seeds, it was probably scratched, which is in all likelihood the reason why the germination power of the sample, being in the first test very high, has already decreased much by the 4th year ; the 5th and 6th year the seed is worthless and the 8th year almost dead.

No. 2 *Trifolium pratense,* was also investigated for the first time in January 1903. It lost its power of germination somewhat less rapidly to the foregoing, because it contained more hard seeds than this and a few per cent. of the seeds retain their germination power much longer than No. 1. It is in this case as always, with regard to the legumes, that the hard seeds keep their germination power longest.

No. 3 *Trifolium pratense,* has comparatively few hard seeds and therefore, in contradistinction to *No.* 4 with many hard grains, loses the germination power rather soon.

No. 5 *Trifolium pratense,* a sample which had at the beginning a low power of germination, is either of a less good quality or of old crop. Already the 3rd year the sample has lost considerably

its germination power, and the 4th year the seed is practically worthless. Curiously enough, this sample in the 4th year only contained 1 per cent. of hard seeds, and during the following years the number of seeds increased which were not swollen at the close of investigation and therefore must be considered hard. The 6th examination shows for instance 11 % hard seeds in the sample, and from the 12th to the 16th year the amount of hard seeds varies from 11 to 13 % while none germinated.

No. 6 *Trifolium repens* the 1st and 2nd year contained but a few hard and no dead seeds and is probably scratched. However, the sample retains its power of germination comparatively long. First from the 6th to the 7th year the reduction is evident, but the 8th year the seed still germinates 43 % and the 16th year 6 % plus 2 % hard.—

No. 7 *Trifolium repens*. This sample does not contain any hard seeds and is probably scratched. It decreases the germination power more rapidly than does No. 6. The sample in question contained already the 3rd year 12 % dead seeds. The 9th year it was almost dead, whereas:—

No. 8 *Trifolium repens*, which had the 1st year a content of 41 % hard seeds, kept the germination power better. Still the 16th year the germination power is 9 % plus 24 % hard seeds. It is one of those samples which have kept the germination power longest.

No. 9 *Trifolium repens*, is the same as No. 8 but scratched after the first test. This has been done very carefully between two pieces of emery-paper. After the scratching the sample does not during the first years contain any hard seeds, and just like the unscratched, only one 1 % dead seeds. The 3rd year the amount of dead seeds is 5 %, and the 4th year 18 %, whereafter the germination power decreased rather equally. Mention should be made of the fact that some few samples, having the first year no hard seeds, in later investigations contained several hard grains. Both No. 5 *Trifolium pratense* and No. 9 *Trifolium repens* in which the content of the hard seeds seems to increase the longer the samples are lying, are of interest in this respect. It is, however, not possible to give a full explanation of the phenomenon ; the reasons are probably that the seed has been stored in a warm, comparatively dry room, and the scratching was so slight that the seed shell has been able to harden itself so that the water could not force its way through

the shell. It is, however, not safe to say that all the seeds, which at the end of the germination test prove hard are alive.

Since 1891, a sample of each of the most important seed species tested at the Danish State Seed Testing Station has every year been put aside and stored in a drawer at usual room temperature. In order to get some account of whether the hard seeds, after having lain during so many years, have kept their power of germination or not, 300 pure seeds drawn arbitrarily from a sample of *Trifolium repens* sent in for testing 25 years ago have been placed to germinate simultaneously with 200 seeds, *i. e.* about 7 % of the sample, having a good, fresh colour. The seed, drawn arbitrarily in 9 days, germinated 2 %, 9 % hard. The fresh-looking seeds germinated 23 % after 8 days. Of the remainder 97 seeds, *i. e.* 49 % were then hard. These were scratched and again placed to test. Two days after, 65 seeds of the scratched seeds had germinated with well developed sprouts. This investigation shows that the main part of the fresh-looking seeds have yet, (after having lain during 25 years) their full power of germination and that most of them as *Trifolium repens*, are still hard after that space of time and can only be made to germinate by scratching.

No. 10 *Trifolium repens* has from the first a low power of germination. It contained the last year 34% dead seeds but retained its germination power almost unaltered during the first three years whereafter an equal decrease takes place. The sample contains still in the 16th year 3 % germinated and 7 % hard seeds.

No. 11 *Trifolium hybridum* has the 1st year a high power of germination and but 4 % hard seeds. The 4th year the sample had lost much of its germination power which decreases thereafter so rapidly that the seed is practically without value the 6th year. Yet the 16th year the sample contained 6 % hard seeds but none germinated.

No. 12 *Trifolium hybridum* contained the first year 10 % dead seeds. The 3rd year the germination power had decreased considerably. The 11th year the sample only contained 1% germinated plus 3 % hard seeds.

Both No. 13 and 14 *Medicago lupulina* had the first year a high germination power and 1 and 0 % hard seeds respectively. The samples, especially No. 14, have the third year a much lower germination power than the 1st year, and the reduction continues

uniformly. The samples contain, however, the 16th year still 3 and 7 % germinated seeds respectively.

No. 15 *Medicago lupulina* had the 1st and 2nd year 6 % and the 3rd year 30 % dead seeds after which the germination power decreased; in the 11th year it was merely 4 % and the sample then contained no hard seeds. It is very small-seeded and probably a cleaning sample.

It must still be remembered that the seeds of *Medicago lupulina* and *Anthyllis vulneraria* are exposed in the threshing to such rough treatment that many of them being hard before the threshing after this lose their hardness. If the seed be stored unthreshed in the husks it would certainly keep the germination power better than similar seeds threshed by the usual threshing machines.

The hard threshing frequently causes the seeds of *Medicago lupulina*, *Anthyllis vulneraria*, and often *Trifolium pratense*, to contain a good many broken seeds. These seeds are in the purity test counted as pure seed because the seed shell does not have any break or wound suggesting that the embryo is injured; but during the germinating process the cotyledons and the radicle break from each other so that they cannot give a plant capable of development wherefore the broken seedlings are counted dead. Under the threshing the seed has been squeezed and within the shell a breach has taken place between the radicle and the cotyledons. In most cases the content of broken seeds is a few per cent. but reaches, however, in some cases 10 to 20 per cent. Germination results obtained at various seed testing stations of a sample with a comparatively great amount of broken seedlings often vary considerably, as a thorough inspection under the germination test is necessary if the broken seedlings, which are mainly to be found among the seeds germinating most rapidly are to be accounted for.

No. 16. One sample only of *Medicago sativa* was tested. This had the 1st and the 2nd year, a germination power of 94 % plus 5 % hard seeds and contained the 4th year 77 % germinated and no hard seeds. The sample loses thereafter its power of germination very slowly. The 16th year it still contained 33 % germinated and 2 % hard seeds.

The results of the examination of the sample of *Medicago sativa* recorded in table I *a*, show that this has kept the germination power better than have the other species of the legumes tested. In order to get information as to whether *Medicago sativa* is as a rule able

to keep its germination power better than the other legumes for grass lands; 6 old samples of the species in question were placed to germinate 23rd of April 1924 with the following results:

Mark	Germinated seeds		Germinated seeds 1924	
	Period	%	Pure seed drawn arbitrarily from the sample	Seed having a good, fresh colour
			%	%
A	1898–99	89 + 9	38 + 0	56 + 6
B	1902–03	82 + 17	46 + 4	73 + 20
C	1906–07	87 + 9	57 + 4	89 + 4
D	1907–08	83 + 11	62 + 3	91 + 6
E	1909–10	89 + 8	67 + 2	97 + 1
F	1914–15	71 + 23	62 + 6	88 + 10

As was expected the fresh-looking seeds of *Medicago sativa* as well as *Trifolium repens* were mainly hard, but most of them have, in spite, of the old age, germinated normally without being scratched. This investigation confirms on the whole the results stated in the two tables with regard to *Medicago sativa* and also that this species seems of the common legumes for grass fields that which keeps its germination power best, at all events under conditions of storing such as those mentioned in this report.

No. 17 *Anthyllis vulneraria*. One sample only was tested of this species. The 1st and 2nd year the sample did not contain any dead seeds; the 3rd year the germination power had decreased 13 % and in the 4th year 22 % + 5 % hard seeds and the 6th year only 3 % + 4 %. Without doubt of the species of legumes used for grass fields this decreases the germination power most rapidly.

According to the investigations made, those samples which have at the beginning a high power of germination and only a few or no hard and dead seeds, decrease this power faster than such samples which contain many hard seeds but no dead seeds. The reason is that the hard seeds are, as a rule, the most ripe and best developed and contain comparatively less water than the other seeds in the sample; according to preliminary investigations made here they seem to contain 1-2 % less water than those seeds which most rapidly absorb water. The investigations in this respect will be continued.

As it appears from the above, well-germinating seeds of the named legumes, stored under conditions essentially more dry than those that are common in the firms' store-rooms, and placed to ger-

minate under more favourable circumstances than the seed will get in practice, keep their germination power unaltered the 2nd and 3rd year, but in the 4th year an essential reduction — continuing during the following period — will take place. The germination speed which decreases earlier than the germination power, is in some cases already a little lower the 2nd year than the 1st. A series of investigations made by "Statsfrøkontrollen" (1) have shown that the germination power in the soil bears a close relation to the speed of germination of the seed. In the case of two seed consignements with the same power but different speed of germination, the seeds with the highest speed should always be preferred (see the example on page 299). A sure rule, with but a few exceptions, is that the higher the speed and the power of germination of the seed the finer and the better developed are the resulting crops.

Also the various species of grass seed retain the germination power differently.

No. 18 *Phleum pratense*. This sample had the 1st year both high speed and power of germination which it kept the 2nd year. The 4th year a reduction had taken place and this continued rapidly during the following years. The sample had the 7th year a speed and power of germination of respectively 9 and 50 % and the 11th year the seed was dead. The sample in question was of American origin and the seed was grown under conditions essentially more dry than those under which European timothy is produced. In consequence of this, American Timothy contains more hulled seeds than the European; with regard to the lower germination power of such hulled seeds (see the report mentioned in the foot-note. The European timothy has, as a rule, a higher water content than the American.

The two samples of *Phleum pratense* No. 19 and 20, of Danish and Saxon origin respectively, have at the beginning a lower germination power than the American sample and decrease — as appears from the table — also more rapidly the speed and power of germination. The 4th year, in which the American sample had still 95 % germinated seed, the two others had respectively merely 47 and 59 %. The 7th year but 10 and 5 % of the seeds of the two samples germinated.

(1) Described in K. Dorph Petersen's "Meddelelse om forskellige Undersøgelser ved Statsfrøkontrollen i København" (Report on investigations made at the State Seed Testing Station, Copenhagen) with an English summary ("Nordisk Jordbrugsforskning", 1922 pp. 429-441).

TABLE

	Medicago lupulina					*Medicago sativa*		*Anthyllis vulneraria*	
	No. 13	No. 14		No. 15		No. 16		No. 17	
	Germination power	Germination speed	Germination power	Germination speed	Germination power	Germination speed	Germination power	Germination speed	Germination power
	%	%	%	%	%	%	%	%	%
1. year	98 + 1	98	99 + 0	79	88 + 6	68	94 + 5	90	93 + 7
2. year	95 + 1	95	97 + 0	83	88 + 6	80	94 + 5	89	92 + 8
3. year	81 + 0	64	65 + 0	63	67 + 3	82	90 + 4	76	82 + 5
4. year	75 + 0	56	57 + 0	35	39 + 1	71	77 + 0	18	22 + 5
5. year	59 + 0	43	47 + 0	36	37 + 2	64	69 + 1	5	6 + 4
6. year	39 + 0	34	36 + 0	15	18 + 1	49	66 + 2	3	3 + 4
7. year	30 + 0	26	28 + 0	9	11 + 2	48	67 + 1	—	—
8. year	30 + 0	28	28 + 0	9	9 + 1	42	59 + 3	—	—
9. year	17 + 0	20	20 + 0	3	4 + 4	35	53 + 1	—	—
10. year	17 + 0	20	23 + 0	3	3 + 3	32	47 + 1	—	—
11. year	11 + 0	15	17 + 0	3	4 + 0	31	56 + 1	—	—
12. year	12 + 0	16	16 + 1	—	—	28	41 + 3	—	—
13. year	5 + 1	9	11 + 0	—	—	16	35 + 2	—	—
14. year	5 + 1	9	9 + 0	—	—	24	36 + 2	—	—
15. year	7 + 1	13	13 + 0	—	—	23	36 + 3	—	—
16. year	3 + 0	7	7 + 0	—	—	21	33 + 2	—	—

TABLE 2-*b*.

	Phleum pratense						*Lolium perenne*						*Lolium italicum*						*Festuca pratensis*					
	No. 18		No. 19		No. 20		No. 21		No. 22		No. 23		No. 24		No. 25		No. 26		No. 27		No. 28		No. 29	
	germ. speed	germ. power	germ. speed	germ. power	germ. speed	germ. power	germ. speed	germ. power	germ. speed	germ. power	germ. speed	germ. power	germ. speed	germ. power	germ. speed	germ. power	germ. speed	germ. power	germ. speed	germ. power	germ. speed	germ. power	germ. speed	germ. power
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
1. year	98	99	84	93	80	88	96	99	86	94	77	85	89	93	80	89	56	68	89	98	93	98	34	49
2. year	99	100	84	92	83	89	94	96	82	88	82	87	88	94	81	89	54	61	91	96	92	96	27	42
3. year	96	99	63	82	75	83	93	96	79	86	71	78	85	89	83	92	36	47	78	91	79	92	18	31
4. year	93	95	28	47	45	59	79	83	55	69	56	65	70	78	62	72	20	30	38	49	27	51	1	6
5. year	72	83	9	17	13	32	66	80	39	55	46	63	61	66	54	65	15	23	6	15	6	17	0	2
6. year	37	64	7	12	3	19	51	71	18	34	24	42	51	60	43	56	6	15	1	6	1	7	—	—
7. year	9	50	3	10	0	5	26	47	6	26	5	18	33	48	30	43	2	7	0	1	0	3	—	—
8. year	7	30	1	5	0	1	18	39	2	11	4	15	18	34	18	29	0	3	—	—	—	—	—	—
9. year	0	13	0	1	—	—	13	24	2	5	2	5	10	28	7	20	0	2	—	—	—	—	—	—
10. year	0	6	—	—	—	—	1	8	0	1	0	3	1	10	2	11	—	—	—	—	—	—	—	—
11. year	0	1	—	—	—	—	0	4	—	—	—	—	0	5	0	4	—	—	—	—	—	—	—	—
12. year	—	—	—	—	—	—	—	—	—	—	—	—	0	1	—	—	—	—	—	—	—	—	—	—

TABLE 2-c.

	Dactylis glomerata								*Avena elatior*				*Bromus arvensis*				*Alopecurus pratensis*						*Poa trivialis*	
	No. 30		No. 31		No. 32		No. 33		No. 34		No. 35		No. 36		No. 37		No. 38		No. 39		No. 40		No. 41	
	germ. speed	germ. power	germ. speed	germ. power	germ. speed	germ. power	germ. speed	germ. power	germ. speed	germ. power	germ. speed	germ. power	germ. speed	germ. power	germ. speed	germ. power	germ. speed	germ. power	germ. speed	germ. power	germ. speed	germ. power	germ. speed	germ. power
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
1. year	93	99	88	99	90	99	35	65	92	96	75	82	93	96	47	54	71	88	57	76	39	53	71	92
2. year	91	98	88	97	86	96	30	63	89	94	61	73	90	93	44	51	67	78	45	64	36	44	47	70
3. year	90	94	87	95	78	92	21	45	74	83	62	71	73	84	30	34	50	62	32	47	22	33	30	49
4. year	77	90	78	92	33	56	5	14	55	66	47	60	16	28	4	7	20	27	12	21	4	12	1	5
5. year	70	90	55	82	15	34	1	8	31	45	23	40	2	3	1	1	4	11	3	4	3	9	0	1
6. year	52	72	37	61	5	8	2	3	13	22	15	23	—	—	—	—	1	1	—	—	1	3	—	—
7. year	41	69	22	54	1	6	—	—	3	14	3	14	—	—	—	—	—	—	—	—	—	—	—	—
8. year	19	44	19	34	0	1	—	—	4	7	3	7	—	—	—	—	—	—	—	—	—	—	—	—
9. year	7	22	5	17	—	—	—	—	0	2	0	5	—	—	—	—	—	—	—	—	—	—	—	—
10. year	2	10	2	9	—	—	—	—	—	—	0	1	—	—	—	—	—	—	—	—	—	—	—	—
11. year	1	7	0	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
12. year	0	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

TABLE 2-(

	era		*Brassica campestris rapifera*				*Daucus carota*					
	No. 56		No. 57		No. 58		No. 59		No. 60		No. 61	
		Germination power	Germination speed	Germination power	Germination speed	Germination power	Germination speed	Germination power	Germination speed	Germination power	Germination speed	Germination power
	%	%	%	%	%	%	%	%	%	%	%	%
1. year .	9	81	86	100	63	83	83	88	56	64	9	37
2. year .	9	79	60	99	37	79	64	81	55	64	11	32
3. year .	6	75	79	93	46	75	75	82	48	54	4	17
4. year .	9	74	61	95	32	61	49	62	35	42	0	1
5. year .	8	76	39	89	22	51	42	46	23	32	0	1
6. year .	0	66	24	85	12	50	19	37	15	24	—	—
7. year .	0	55	2	85	2	45	16	26	8	15	—	—
8. year .	3	59	1	76	0	43	9	20	6	20	—	—
9. year .	0	39	0	62	0	28	6	16	2	8	—	—
10. year .	0	35	0	54	0	37	1	5	0	5	—	—
11. year .	0	16	0	24	0	21	0	4	0	1	—	—
12. year .	0	9	0	23	0	12	—	—	—	—	—	—
13. year .	0	1	0	7	0	4	—	—	—	—	—	—
14. year .	—	—	0	1	—	—	—	—	—	—	—	—
15. year .	—	—	—	—	—	—	—	—	—	—	—	—
16. year .	—	—	—	—	—	—	—	—	—	—	—	—
17. year .	—	—	—	—	—	—	—	—	—	—	—	—
18. year .	—	—	—	—	—	—	—	—	—	—	—	—

No. 21 *Lolium perenne* is Danish and has, similar to Danish seed of the *Lolium* species, *Festuca pratensis*, *Dactylis glomerata*, etc. a high speed and power of germination the 1st year. The 2nd and 3rd year a slight reduction takes place which increases considerably the 4th year, but the sample has even in the 9th year a germination power of 24 %. The 11th year the seed is almost dead.

No. 22 (of Irish produce) and No. 23 *Lolium perenne* decrease as is shown in the table, more rapidly in germination power than No. 21. The same is true with regard to the samples of

Lolium italicum of which species No. 24 keeps the germination power a little better than No. 25 (Irish) and No. 26. The seed of *Festuca pratensis* seems to keep the germination power less well than the two species of *Lolium*, even if it has, like the samples No. 27 and 28 (respectively of Danish and American origin), at the beginning a higher power of germination. The 4th year the reduction is considerable and the 7th year the samples are practically dead.

No. 29 *Festuca pratensis*, which is produced in America, had already the 1st year a poor germination power and was in all likelihood of old crop ; it loses its germination power quickly and is almost dead the 5th year.

No. 30-31 and 32 of *Dactylis glomerata* show the importance of a high germination speed of the seed. All three samples have the 1st year a germination power of 99 % ; but No. 30, which has a germination speed of 93 %, retains both power and speed of germination better than No. 31, that has the germination speed 88 % and especially than No. 32, the germination speed of which is only 70 %.

That No. 33 *Dactylis glomerata*, the germination speed of which is the first year but 35 % and the power of germination 65 %, decreases more rapidly in germination power than the other three samples of *Dactylis glomerata* is quite natural. The seed is probably some years old.

The two samples No. 34 and 35 of *Avena elatior* seem to be an exception to the rule, as they retain their germination power about equally long, although No. 34 has a considerably higher speed power of germination than No. 35. Mention should, however, be made of the fact that No. 35 has decreased in speed and power of germination respectively 14 and 9 % the 2nd year, while No. 34 has

kept both almost unaltered. No. 35 is perhaps a mixture of old and new seed.

No. 36 *Bromus arvensis* has the 1st year a normal power of germination and retains this almost unaltered the 2nd year. The 3rd year the germination power decreases considerably and the 4th year the sample is practically worthless. Attention must, however, once more be called to the fact that the conditions of storing of the Seed Testing Station are better than those in ordinary practice. Investigations have shown that seed of the species in question stored under ordinary circumstances, during the 2nd year loses somewhat and the 3rd year much of its germination power.

Of the most commonly used grasses *Bromus arvensis* is the species which ripens latest, hence seed of this produced under corresponding conditions to the other grass seed species, has in general a greater water content than these. This is probably the reason why *Bromus arvensis* decreases more rapidly in germination power than most of the other grass seed species.

The samples No. 38-40 of *Alopecurus pratensis* have, as is normal for this species, even in the 1st year a comparatively low speed and power of germination and this decreases somewhat the 2nd year, and the 3rd year a good deal. The same is true with regard to the sample No. 41 tested of *Poa trivialis* but this has also a germination speed of but 71 %, which is lower than normal for Danish grown seed of *Poa trivialis*.

It can as a rule be said that when the grass seed the 1st year has a good speed and power of germination and is stored under favourable conditions, it is able to keep the germination power unaltered for 2 years, while a marked reduction seldom takes place in the 3rd year. Grass seed of so old crop has therefore considerably less value for seeding purpose than new seed.

As appears from the table (Table 2-*d*), a great number of samples (13) of *Beta vulgaris* were tested. It should be noticed that the samples are not all of the same crop. No. 46 was grown in 1898, No. 43 in 1899, No. 47 in 1900, Nos. 42, 44, 45, 48 and 49 in 1901, while Nos. 50-54 in 1902, which year the germination power of the beet seed produced in Denmark was, on account of frost in September, in general very low.

As is seen from the table, those samples which have at first

a high germination power, retain this almost unaltered during the first 4-5 years or more. In the 6th-9th year they have a fairly good power of germination. It is noticeable that the germination power is, with regard to a series of these samples, higher the 2nd and the 3rd year than the 1st and 2nd respectively. Even most of those which had the 1st year a low germination power keep this nearly unaltered the first couple of years.

No. 42 *Beta vulgaris* which had at the beginning the best germination speed and power (89 and 93 %) keeps this almost unaltered until the 6th year, whereafter a decrease takes place very slowly.

The sample has the 10th year a germination speed of 73 % and a germination power of 79 %, and even in the 17th year a germination power of 24 %.

Also the samples of *Brassica napus* and *Brassica campestris rapifera* No. 55 and 57 which have a high germination power retain this almost unaltered the first 4 to 5 years. In the 7th year they have a germination power of respectively, 86 and 85 %, and are not dead before the 13th or 14th year.

It is noticeable that the germination speed of the samples in question decreases more rapidly than does the germination power. As the germination energy, *i. e.* the ability of the seed to germinate in short time in the soil, as mentioned before, bears a close relation to the germination speed, it is very important, when buying seeds — especially of the root species, but also of others — to be sure that the germination speed as well as the germination power is good. The importance of using a seed having a good germination speed appears from the following example: Two samples of *Brassica campestris rapifera* seed, *A*, and *B*, were tested in the laboratory and both were found to have a germination power of 95 % after 8 days germinating. 91 % of *A* germinated in 2 days, and 36 % of *B*. These figures indicate the respective rates of speed. In the experiment field belonging to the State Seed Testing Station, 400 seeds of each sample were sown under exactly equal conditions.

71 % of samples *A* germinated in the field in 3 days and 77 % in 4 days. 5 % of sample *B* germinated in the field in 3 days and 33 % in 4 days. This shows the importance of using a seed that germinates rapidly and well. The field sown with seed similar to

sample *A* can be horse-hoed between the rows 3 days after being sown, as the rows of germinating plants are then already visible. Then also, a compact crop can better withstand attacks of flea-beetles or other pests than a thin, sickly crop which sample *B* is sure to yield.

The samples are tested for the number of days used here in the laboratory for the species concerned, viz. 3 and 10 for *Brassica napus rapifera* and 2 and 8 for *Brassica campestris rapifera*. A couple of the tests have been extended until 20 and 15 days, whereby a germination power somewhat higher than the results stated in the table for the particular samples is found. The rates of germination obtained in that way have, however, no practical significance because a seed that germinates so slowly is not capable of development in the field.

The two other samples of the *Brassica* species No. 56 and 58 have a lower germination power than the first-mentioned and decrease also a little more rapidly in germination power than these.

The samples of *Daucus carota* lose, as is also known from practice, the germination power quicker than the three former species, especially a sample like No. 61, which has at first a low germination power will very soon be practically worthless.

Also with regard to the vitality of weed seeds a series of investigations — a report of which will be given in a further article — have been made at the Danish State Seed Testing Station.

As emphasized before, the conditions under which the samples tested have been stored here, are considerably different from those in the common store-rooms. The results obtained in our examinations are therefore no doubt able to give some information regarding the ability of the varied seed species to retain their germination power, but it will certainly not be safe from these investigations to draw the conclusion that seed kept in store-rooms is able to retain its germination power during so long a time as has been the case with the sample stored at the State Seed Testing Station.

In order to learn how normally harvested and treated seed for our most important crop species, when kept in common store-rooms, is able to retain its germination power, the Danish State Seed Testing Station intends again this year to carry out germination tests in regard to seed stored under ordinary practical conditions. Simultaneously with these investigations, the water content of the

samples should be examined at various seasons. As to the question of water content, a series of results of investigations in that respect are to be found in a report from the Danish State Seed Testing Station, composed by M. N. SIGGARD: "Om Opbevaring af Korn og Fro." (On storing of cereal seed and other seed). The report contains an English summary (1).

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(1) *Tidsskrift for Planteavl*, Vol. 28, page 286-311.

THE SUGARCANE IN BRAZIL AND ESPECIALLY IN THE STATE OF BAHIA HISTORICAL NOTES: VARIETY TRIALS.

The "Ubá" Sugarcane, and the beginning of Sugarcane Cultivation in Brazil.

At the "Aprendizado Agricola da Bahia" (at Villa de S. Francisco) of the Ministry of Agriculture, Industry and Commerce, the "Ubá" sugarcane is being cultivated experimentally. This variety is superior to all others from the points of view of drought-resistance and high yield (crop 56.25 to 157.50 tons per hectare). While out of the 28 varieties grown in the "Campo de Experimentacão" of Pitinga, Santo Amaro (State of São Paolo), only one, "Caienna", was found to produce a purer juice than "Ubá". The analyses. made in July, August and November by the chemist Giuseppe Martina (see *bibliography* 1) proved the juice of this cane to contain 17.87 % of sugar while its purity was 91 %. In his book entitled *Chimica agricola*, Señor Nicolau Moreira states that he found by analysis 18.65 % of saccharose in the juice; therefore, since the canes produce 50.88 % of juice, 100 kg. of cane contains 9.49 kg. of sugar. To its other good qualities the "Ubá" variety unites the merit of hardiness.

This variety of sugarcane appears to be indigenous in Brazil, at any rate, this is the opinion of the historian Frei Antonio de Santa Maria Jaboatão (II, p. 121) and others.

The variety known as "canna mirim" (small cane), or "creoula" (creol) because it is regarded as a native of Brazil, would seem to have been introduced from Malabar, or Bengala (*ibidem*, p. 110). It was cultivated by the Parecis Indians at St. Vincent (Matto Grosso), whence it spread to the other coast regions. This cane is light-coloured, being of a greenish yellow hue; the pith is soft and succulent and nearly as thick as that of the "Ubá" variety, but is much shorter, for frequently it is does not attain a greater height at

complete maturity than that reached by " Ubá " in 7 months (2.30 m.), when the canes are still soft and only have 2 or 3 internodes.

The introduction of the sugar-cane into Brazil must date back to 1503 or 1504, the time of the arrival of the first " estanco "(band of Portuguese colonists) sent under the command of CHRISTOVÃO JACQUES, or of GONÇALO COELHO by Don MANOEL in 1503-1504 (III, pp. 151 and 161). In note 16 to page 203, Prof. BRAZ DO AMARRAL states that the expedition which founded the " feitoria " of Santa Cruz was under the command of GONÇALO COELHO, not that of CHRISTOVÃO JACQUES, who could not have come to Brazil in 1504. There is no doubt that the sugarcane was introduced into the island of Tinharé, or Morro do São Paulo (where FRANCISCO ROMERO established the first nucleus of the colony of Ilheos on the northern coast of the island, between 1524 and 1537), by JORGE DE FIGUEIREDO CORREIA who made the first plantation with material coming from Cape Verde. At the same time, the sugarcane was introduced by MARTIM AFFONSO DE SOUZA into St. Vincent, the canes having been brought from Madeira. From the coastal district of Ilheo, the plant was introduced into Bahia (Municipality of Salvador) by FRANCISCO PEREIRA COUTINHO.

The " Tahiti " variety (Caienna) came from French Guiana whence it was sent by the Governor JOÃO SEVERIANO MANOEL DA COSTA, Marquis of QUELUZ. This variety was mentioned on the occasion of the visit paid by the Royal Family to Brazil (1808) with the object ot taking possession of Cayenne in the name of Portugal. According to ESTACIO DE SÁ E MENEZES (IV, p. 229), the French Governor, VICTOR HUGUES, capitulated and left for France with the whole garrison in 1809. The first slips of the sugarcane " cayenna imperial " as well as the first sugarcane mill, which was driven by steam, were introduced into Brazil by Marshal FELISBERTO CALDEIRA BRANT PONTES, Marquis of BARBACENA (V).

" The Portuguese found many varieties of cane (the " ubá " of the Indians, " Canna brava ", *Ginnerium saccharoides*, *Saccharum sagittatum*), but the true sugarcane (*Saccharum officinarum*) was imported from the island of Madeira (*Historia do Brasil*, p. 238). On pages 60 and 62 of the same work, Estacio DE SÁ says. " The sugarcane was introduced into Sicily, thence into Madeira, and later into this Island of St. Vincent ".

After his return to Portugal, MARTIM AFFONSO DE SOUZA despatched slips of sugarcane, among other things, from Madeira to

Brazil between 1535 and 1538. As we have seen, however, sugarcane cultivation had been introduced in Bahia by THOMÉ DE SOUZA in 1549. Sugarcane was perhaps grown in Porto Seguro in the year 1504 and in Morro de San Paulo between 1535 and 1537.

Even assuming that sugarcane growing was begun in 1534 in Morro de San Paulo, in Porto Seguro or in the Municipio do Salvador, since in that year deeds of gift were conferred on FRANCESCO PEREIRA CONTINHO on April 5, 1534, on PEDRO DE CAMPOS TOURINHO on September 23, 1534, on JORGE DE FIGUEIREDO CORREIRA E. ALCARCÃO on July 26, 1534 (ACYOLI, op. cit., p. 190), sugarcane cultivation in Bahia would date back to the time when is is believed that MARTIM AFFONSO DE SOUZA and his brother PERO LOPES built the sugar-factories of Itamaracá (Pernambuco) and St. Vincent (San Paolo). Some persons however maintain (MEDEIROS and ALBUQUERQUE, op. cit., p. 121) that as early as 1527, Pernambuco paid tithes in sugar, and find from the history of the colonisation of Porto Seguro that in 1503, sugarcane cultivation was introduced together with the "estanco."

These dates only show the antiquity of sugarcane growing; the hardiness of the "Ubá" variety and the fixity of its characters make it probable that this sugarcane at least is indigenous in Brazil as JOBOATÃO among other historians believes. "Ubá" means "wild cane." This variety is resistant to weather, drought and to the attacks of both animal and plant parasites. The analyses quoted above show its economic superiority, since no other variety whether, red or white, produces in Brazil as much as 95 kg. of sugar per ton of cane. The average production of the cultivated varieties is estimated at about 60 kg. per ton of cane.

The "Cristallina" variety which gives a very high sugar percentage when grown at the "Aprendizado", in Cuba, does not maintain its reputation in Brazil.

In Pernambuco, the varieties "Conferencia", or "Manoel Cavalcanti", and "Manteiga" are largely grown; the latter, however, seems the best, since when grown at the "Aprendizado" it proved to be early maturing, vigorous, and equal even to "Flor de Cuba" as regards height and diameter of the canes which often attain the height of 4 m. and more, while they weigh up to 8 kg.

The variety "330" which is considered very pure and rich in sugar is being grown experimentally at the "Aprendizado".

Varieties of sugarcane that have originated as a result of mutation. — In 1917, there appeared among the varieties cultivated at the " Aprendizado " a mutant characterised physiologically by greater sugar content and morphologically by the loss of hairs on its leaves due to the absorption of less soluble, allotropic silica (VI).

This new variety was given the name of " Seda de brotas. "

In 1923, another mutant was observed. This was characterised by thinner, shorter internodes than those possessed by the other varieties grown on the same area (" Cayenna ", " Manteiga ", " Bourbon " and " Salangor "). The canes were parti-coloured (yellow, green, pale-pink) the bud was surrounded by a green ring, the nodular protuberances from which the rosts grow when the cane is propagated from slips were more marked than usual ; leaves 17.2 mm. in width (intermediate between " Cayenna " 60 mm. and " Mainteiga " 80 mm.), while the tissues of the walls of the canes were more resistant than in the case of the 4 above-mentioned varieties.

The phenomenon of mutation is rare, but has long been known to occur ; the new varieties of sugarcane propagated exclusively agamically, have all been obtained by means of mutation. Reproduction from seed which is at present practised in selection work at the Experiment Stations was also adopted, according to Bruce, in Egypt. In the eighteenth century and at the beginning of the nineteenth century, the idea that the sugarcane could produce seed began to be entertained. In 1888-89, according to Cross (VII), in 1884, according to M. A. Santos Filho (VIII, p. 23), Soltvedel in Java and Harrison and Bovell in the Barbados obtained new varieties from fertilised seed.

Bateson and De Vries employ the term mutation to denote the sudden deviations from the usual type which occur in the case of plants propagated from eyes or slips. The change is due according to Leclerc du Sablon (IX, p. 591) to the sudden appearance of a new character and to the absence of any forms intermediate between this character and the original character proper to the variety. Mutation is not the result of the accumulation of slight imperceptible changes ; the new characters and the new variety make their appearance suddenly, while the intermediate forms drop out, contrary to the aphorism of Leibnitz, " natura non facit sáltus ", which does not allow the existence of different genera

without their intermediate forms. In the case of mutation, however, it is a case of varieties of the same species.

The " fita " (striped) variety of sugarcane first planted at the " Aprendizado " as long ago as 1912, showed in September-October 1923 the following modifications : from the same stool there arose striped canes and other canes that had completely lost this unstable character. The striped canes had dark lines, or bands, on a light-green ground. On examining the striped stems, the following alterations were observed : no stripes occurred between the first and the second internode nor between the twelfth internode and the top, the third internode had two dark green bands or zones, the fourth internode had 5 narrow, green stripes, the fifth had only two stripes scarcely 3 mm. wide and a central band 7 mm. broad ; the sixth had 8 stripes, one 1 cm. wide ; one 6 mm. wide, two 4 mm. wide, and four barely 1 mm. wide ; the sixth had 6 stripes, one 13 mm. broad ; one 10 mm. broad ; one 6 mm. broad ; two 3 mm. broad and one scarcely 1 mm. broad ; the eighth had four stripes, one of 6 mm., one of 5 mm., and two of 3 mm. ; the nineth had two stripes 4 and 2 mm. broad respectively ; the tenth had 3 stripes, the widest being 7 mm. and the 2 others 4 mm. broad ; the eleventh had five stripes, one of 7 mm. and four of 3 mm. This mutation is a throw-back to the primitive type. The phenomenon of green canes produced by striped varieties had already been recorded by J. T. Horne.

Enemies and Parasites. — The " Ubá " cane though only recently planted, viz. it had only one leaf, and grew very near to the " roxas " cane of the fourth cutting in spite f the undoubted hardness of the walls of its stems, was attack n Brotas by the larvae of "broa" (*Diatraea saccharalis*). I said that at Pernambuco, this lepidopteron only attac canes after the sixth cutting (XI).

In July, August and September, I found many canes perforated by the " broca " and others bent, broken, and sucked by foxes (*Canis vulpes*), the " guará " (*Canis jubatus*) and the " guaxinim " (*Galidictus vittata*) the first of these animals lives in the woods while the other two haunt the banks of streams, and at times invade the sugarcane plantations where they do much mischief. The stems of the " Ubá " variety have hard walls and compact closely-set wood-bundles, so that they are difficult to cut, but they are sucked in preference to the softer-walled stems of the other varieties. I

think this anomaly may be explained by the fact that the stems of "Ubá" being thicker than those of the other kinds, can be easily seized by and held between the teeth of the above-mentioned mammals.

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VINE CULTIVATION AND THE WINE INDUSTRY IN JUGO-SLAVIA

I. General.

The present kingdom of the Serbs-Croats and Slovenes (Jugo-Slavia) consists as to one third of the old Serbian territory, and as to two-thirds of the countries annexed by Austria, Hungary, Turkey, Bulgaria and Montenegro, and inhabited for the most part by peoples of Serbian origin.

These two parts of the present Jugo-Slavia are devoted exclusively to agriculture which in all its different branches is the basis of the prosperity of the people and the economic life of the Kingdom, and at the present time has an area of 248 000 square kilometres.

Crops, pasture, and forestry are the three outstanding features in the national economy. Fruit growing, and vine growing are general, as is the case in all southern countries where soil and climate are suitable. Vine growing, however, though highly important, is not the principal object of cultivation. Vines have been grown in the Balkan regions since the times preceding the immigration of the Slavs. When the Serbian tribes of the VIth and VIIth centuries, gradually came to occupy their present territory, they found the vine already being cultivated. The natives (Illyrians and Thracians) and the Roman and Byzantine colonists instructed them in viticulture and wine-making. Until that time, in their former home in the Russian Steppes and Galicia, the Serbs, like all other Slavs, knew how to produce and drank solely beverages made from fruits, cereals (beer and "kvass") and honey.

The vine is frequently mentioned in mediaeval Serbian literature. The Czar Lazzaro who died in 1389, encouraged the making of new vineyards and distributed the seedlings among the monasteries. the region most suitable for vine cultivation was in the south-west of Serbia which is sunny and has rocky slopes. The vineyards, at

PLATE XIV.

Vines in Jugo-Slavia.

FIG. 43. — Smederevka (native variety).

PLATE XV.

Vines in Jaşo-Sârca.

Fig. 41. — Aduşkalka (native) (1/8).

Vines in Jugo-Slavia.

FIG. 45. — Volugiarsko Oko (native variety).

Vines in Jugo-Slavia.

FIG. 46. — Zatscinak native variety.

Tikveche, the first to be destroyed by phylloxera at the end of the XIXth century, were well known throughout Serbia and those also, in the neighbourhood of Prizren.

The historian, Cedomir MIATOVIC holds that the fertile Métohe and Sitnitza areas are the original home of Serbian vine cultivation. The governor Giuradj BRANKOVIC in the XVth century transplanted vines from his vineyards at Prinzen and Prisetina to the country round his new capital Smederevo on the Danube and also his Hungarian estates at Tokay. The governor Stefano at the end of the XIVth century had previously planted vines of superior quality in the neighbourhood of Belgrade. The wines of Ritopec, a village near Belgrade on the Danube were popular throughout the country from the XIVth till the XIXth century. Wine from Dalmatia was imported at the request of the great Serbian rulers who paid a high price but, received a wine diluted during the journey. They therefore began to encourage local growing and towards the end of the XIVth century successful results were obtained. Vine cultivation was extended and rulers, monks and landowners were known to own well stocked cellars.

The ancient, popular literature of the Serbs including their folk-songs, referred to the wines of that period exclusively as red, brown and purple, and it is clear that as yet the making of white wines was unknown and white wines were first made in Serbia at a much later date. The cinnamon coloured wine, made from a mixture of white and red grapes was prepared in all the villages of the districts situated at a distance from the large centres. This fact confirms the statement made above and shows that owing to lack of initiative, the ancient forms of vinification have been continued even up to the present time.

The cultivated area of the Kingdom covers 10 457 000 hectares *i. e.* 42.5 % of the total area. The vineyards occupy 387 000 hectares, *i. e.* 3.7 % of the national territory. Only half this area according to official reports of the Ministry of Commerce, should be taken into account, as due allowance must be made for vineyards abandoned or damaged by the war or phylloxera. With regard to the effective production of the Serbian vineyards according to the data collected by the Ministry of Agriculture the vineyards shown in the 1922 census covered an area 171 634 hectares. According to the Ministry of Commerce, the average yield value to the producer in 1922 was 141 796 703 French francs. So important an industry naturally

plays a conspicuous part in the national economy. Table I shows the area under vineyards and the wine production in the various regions of Jugo-Slavia.

TABLE I. — *Area under Wineyards and the Wine Production in Jugo-Slavia.*

Countries	Vineyards en 1921	Wine production 1920	1921	1922
	ha.	hl.	hl.	hl
1. Regions, north of old Serbia	25 207,02	434 428	564 389	—
2. » south » » »	12 477,32	198 536	96 732	—
3. Croatia and Slavonia	48 504,90	849 968	847 064	—
4. Bosnia-Herzegovina	6 280	94 293	123 773	—
5. Ex-Hungary (Voivodina)	28 028,54	638 881	572 500	—
6. Slavonia	20 488,64	349 751	564 588	—
7. Dalmatia	29 406,58	534 492	376 596	—
8. Montenegro	1 150,90	5 491	3 947	—
Total	171 634,50	3 105 840	3 149 655	4 615 125
Average par hectare	—	18,10	18,35	27,53

Almost the whole of the product is consumed locally and export is of secondary importance, only amounting to 0.63 % of the total production. The reasons will be seen later. Tables II and III show the export of wine and " rakiya " or grape-skin brandy, and Table IV the total exports of agricultural produce and wine from Jugo-Slavia ; Tables V and VI the distribution of the export of wine and brandy.

TABLE II. — *Export of wine from the Kingdom of the Serbs, Croats and Slovenes.*

	Amounts	Value
	kg.	dinari
1919	9 438 784	28 588 752
1920	2 044 644	6 932 830
1921	1 904 082	5 581 420
1922	8 534 000	28 600 000
1923	1 354 000	7 200 000

TABLE III. — *Export of "rakiya".*

	Amounts	Value
	kg.	dinari
1919	2 204 380	22 005 000
1920	112 479	1 800 005
1921	56 655	557 400
1922	10 000	1 000 000
1923	—	—

TABLE IV. — *Value of the total of exports and of the export of wine.*

	Total export	Percentage of the value of wine exported compared with total export values
	dinari	%
1920	1 320 606 055	0.52
1921	2 460 737 562	0.22
1922	3 071 500 000	0.90
1923	3 333 800 000	0.21

TABLE V. — *Export of grape-skin brandy*, 1920.

Importing country	Quantity	Value
	kg.	dinari
Austria	112 511	2 801 020
Egypt	1 448	26 995
Tchecko-Slovakia	9	185
Total	113 968	1 828 200

TABLE VI. — *Wine exported*, 1920.

Importing country	Quantity	Value
	kg.	dinari
Austria	1 461 898	4 879 517
Italy	107 727	384 524
Hungary	10	50
Roumania	119	480
Tchecko-Slovakia	464 240	1 636 159
Switzerland	70	400
Disputed area	10 580	31 700
Total	2 044 644	6 932 830

Before the war Serbia exported a certain amount of fresh grapes to Austria and Switzerland. At the present time these exports have been suspended, but instead currants have been imported (see Table VII) though the vine districts of Dalmatia, Macedonia in the South of the Kingdom might well produce them themselves.

TABLE VII. — *Importation and exportation of currants and raisins.*

	Quantity	Value
	kg.	dinari
Importation :		
Currants from Greece and Italy	1 517	12 355
Raisins from Spain, Italy, France and Smyrna	585 925	2 175 473
Total . . .	587 442	2 187 828
Exportation :		
Raising to Austria	2	35

In the matter of the area covered by vineyards and average production, the Kingdom of the Serbs-Croats and Slovenes compared with other European countries, omitting Russia, occupies the 6th place as regards area and the 5th as regards production as is shown in Table VIII.

TABLE VIII. — *Area under Wineyards and Wine Production in different Countries.*

Country	Area under vineyards	Wine production
	ha.	hl.
Italy	4 236 000	33 000 000
France	1 584 365	55 248 337
Spani	1 330 513	19 204 303
Portugal	—	3 452 913
Hungary	207 429	2 820 000
Jugo-Slavia	170 841	3 670 444
Greece	170 000	1 816 800
Rumania	132 011	2 370 663
Germany	73 841	1 754 916
Bulgaria	45 138	1 315 760
Austria	37 369	292 478
Switzerland	18 500	400 000
Tcheko-Slovakia	18 500	333 378
Luxembourg	1 500	29 000

Vines in Jugo-Slavia.

FIG. 47. — Prokupatz (native variety).

Vines in *Jugo-Slavia*

Fig. 48. — Kralgevski Drenak native variety

Vines in Jugo-Slavia.

FIG. 49. — Drenak white (native variety).

Vines in Jugo-Slavia.

FIG. 1. — [illegible]

The production in Jugo-Slavia is therefore of considerable importance ; but the wine consumption is confined to the country itself and does not figure in the world wine trade. The following are the chief reasons for this fact : firstly the antiquated methods of wine production employed, and the consequent inferiority of the native wines, and their incapacity to stand long journeys ; secondly, the high cost and defective transport, the high custom duties with their troublesome formalities and the irregularities of the exchange. In spite of this, however, the favourable soil and climate conditions should eventually lead to more satisfactory results both as regards quality and quantity throughout the greater part of the vine-growing areas.

The advances made in agricultural science, thanks to the work of the Viticultural and Oenological Teaching and Experiment Institutes, should have an important part in the future development of the Serbian wine industry. Both the Government and the State Institutions are much interested in the question, although agricultural and especially oenological instruction are only as yet in the rudimentary stage. For a population of 12 million persons of whom 80-85 % make their living by agriculture there are only 23 agricultural schools with a total of 1500 pupils. Two of these schools are of an advanced character, one is a normal school and two are elementary. There is thus one school per 500 000 inhabitants, and every 10 800 square kilometres. On the other hand in Tcheko-Slovakia for example, there are 156 schools of agriculture for 13 500 000 inhabitants ; in Germany where only 28.6 % of the population is agricultural, one school per 107 138 inhabitants and for every 892 km², *i. e.* 1 school for every group of 30 633 inhabitants which live by agriculture.

The Government and the public associations are now working energetically to popularise agricultural instruction and the Agricultural Co-operative Movement. (" Zadrugi ") with its head quarters in Belgrade has already made distinct progress.

II. Vine cultivation and the wine industry in old Serbia.

In old Serbia there are no large vineyards and a vineyard of 10-20 hectares belonging to a single proprietor is very rare.

The northern region, on the banks of the Danube and the Morava is divided into the vine growing districts of Smederevo and Pojarevatz, Negotin, Giupa, Ugitza, Leskovatz etc. The southern region consists chiefly of the provinces which were annexed after the last

war with Turkey ; the area under vines is about one-third that of the northern region, and both the production and the quality of wine are decidedly inferior. This fact, which is at first sight somewhat surprising, is not due to any unfavourable natural conditions but rather to (1) the long duration of the supremacy, of the Moslems whose laws forbid the use of wine ; (2) the devastation caused during recent wars ; (3) the damage done by phylloxera during recent years' aggravated by the emigration of the inhabitants, causing a shortage of labour for the work of re-establishment.

Belgrade and the other chief towns in Serbia consume exclusively the wines from the north or from the provinces of Dalmatia Voivodina and Herzogovina. The south consumes all its own wine production and also some of the wine grown in the northern region.

The vineyards of Old Serbia cannot be said to be in the best possible condition although during recent years there has been a marked improvement.— Phylloxera was prevalent in 1882-84 ; the work of re-establishment was recommenced but is far from being finished and out of 171 634 hectares under vines in the Kingdom, only some 110 000 hectares have been re-established while 61 634 hectares are still unplanted. The proportion of vineyards re-established in Old Serbia is even lower and in the absence of statistics, it may be roughly estimated at 50-60 % of the vine covered area.

Serbian vine-growers appear to prefer using cuttings or layers for propagation purposes in spite of the presence of phylloxera, but although this method is more economical it is decidedly dangerous. Only on the larger estates or where new vineyards are being made, has use been made of American vine stocks. These are not easy to obtain, as the American vine nurseries are few and as a rule belong to private owners. Within the last two or three years, however, several nurseries for American vines have been planted and placed under the control of the Government experts and these are distributed over the whole region reserved for vine culture. The larger number of nurseries are still only at a preliminary stage of development.

Vine stocks at the present time command a high price when purchased from private nurserymen :— viz. 2-3 *dinari* per stock. Their quality leaves much to be desired and insufficient attention is given to the toleration of lime by the various stocks. So far very little has been done in connection with soil study and analysis in the Serbian vineyards. A certain number of schools giving courses in horticulture and wine making are to be found, in Old Serbia but the instruction

is of a very elementary nature. The number of specialists in vine growing who have been trained in Germany, Austria or still less frequently in France, is very limited and far from meeting the requirements of the country.

The oldest school of œnology and the best equipped is situated at Bukovo, near Negotin, in the former Monastery of Bukova. Before the war, this school possessed a fine collection of vines, a laboratory, educational collections, a vineyard covering 25 hectares and cultivated by the students and a fairly well-equipped cellar. After the Bulgarian invasion in 1915, this was all destroyed and the vineyards were abandoned ; at the present time the work of restoration is proceeding. In Old Serbia the following agricultural institutions are to be found : a faculty of agriculture at the University of Belgrade ; five elementary agricultural schools (including Bukovo) and five experiment stations with practical courses.

In general, the attention given to the vines leaves much to be desired. In 1874, M. Millintin Savic, the wine expert said: our wine-making technique and methods of vine-growing are of a primitive order and very little progress has since then been made.

The vines are spaced at 1.50 to 2 m., and different varieties are cultivated indiscriminately. The land is worked two or three times a year chiefly with the hoe and very rarely with the spade. No use is made of animal labour and only occasionally is the land dug up in the autumn after the vintage, in spite of the manifest advantages of this practice. Intensive cultivation from the standpoint of keeping the land free from weeds is relatively low. Primitive methods of pruning, a matter of fundamental importance in wine growing are followed and probably they are still the same as those inherited from the Turks, and such as the writer noticed in 1921 outside Constantinople. Pruning takes place in the early spring and often too late in seasons when the heat beguns early. The branches are cut short even in the case of vines which are better suited to long pruning.

From 2 to 5 branches are left on each stem with 1 or 2 eyes. Raffia is used to tie the stems to the stakes.

There is no original Serbian treatise of any note on national vine-growing and wine-making, in spite of the importance of this branch of agriculture in the country.

As regards peronospora, which is very prevalent, the Bordeaux spray is used 2-3 times each year. Against oidium which is less widespread and confined to certain districts, a sulphur spray is used

2-3 times every season. Anthracnose is frequent but not serious, neither black rot nor any other harmful fungous diseases have as yet been notified. Chlorosis has been reported in isolated cases in different parts of the country. Very few insect pests are known apart from phylloxera. These points are all of importance as regards the future development of vine growing in Serbia, according to modern theory.

The species cultivated include: *Native varieties* Smederevka (see Plate I), Adakalka (see Plate II), Skadarka (Ceterscka or Mekisc.), Zelenika, Voloujarsko Oko (see Plate III), Kamenitcharka (Rskovatz), Zatchinak (see Plate IV), Prokoupat (see Plate V), Nichevka, various types of Drenak, (see plates VI, VII and VIII), Large Dinka, Small Dinka (Ruzhitza or Bagrina (see Plate IX), Lissitchina (Plate X), Gratchevina, Tamjanika (Plate XI), Slankamenka (Majarva), Ranka (see Plates XII and XIII), Verous (see Plate XIV), etc. *Foreign varieties*: table grapes and wine: White Muscat, Madeleine Royale and Madeleine Dorée, Muscat Hamburg (Plate XV), Muscat Malaga (Plate XVI) etc. for wine only. Portuguese, Pinot noir (Burgundaty), Riesling, Traminer, Semillon, Sanvignon, Cabernet Franc, etc. All these foreign varities though only introduced some 20-25 years ago, are well acclimatised.

The wine grapes are chiefly of native origin and the Serbs are conservative in this respect. They appear to be still afraid of using grapes from foreign vines with which they are unfamiliar and up to the present no comparative tests have been made in Serbia with imported varieties, as regards qualities of acclimatisation, productivity, regularity of yield, and quality of the wine obtained. This is at present the most important problem to be studied at the Viticultural Stations and nurseries and by the State experts.

The vintage in Serbia begins at the end of September and lasts throughout October and sometimes also through November, as was the case in 1921. Primitive methods are employed, with no differentiation between grapes of different qualities and ripening at different times, while often the white and red grapes are not separated.

For this reason, the pink or cinnamon coloured wines of all shades are common in Serbia, especially in the Negotin district and among the peasants. Since the vines are distributed promiscuously, even on the same property, the wine from one cask differs from another according to the species particularly prevalent in any one part of the vineyard.

Mechanical presses and crushers are not well distributed in Serbia.

PLATE XXII.

Vines in Jugo-Slavia.

FIG. 51. — Bagrina or Rugitza (Native variety).

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Vines in Jugo-Slavia.

FIG. 52. — Lisitsina (native variety).

PLATE XXIV.

Vines in Jugo-Slavia.

FIG. 53. — Tamgianica (native variety).

Vines in Jugo-Slavia.

FIG. 54. — Ranka white (native variety).

As in old times, the peasant generally crushes the grapes on the hollowed stones or in the vat, with a simple two-forked stake. After wine-must has been extracted, the skins are fermented for distillation without further pressing. Crushers are often used but not presses as in the neighbourhood of Negotin and where the wine press has been introduced as at Belgrade, Smederevo, Giupa, Negotin etc. the grapes are insufficiently pressed, and the result is only first extract wine with a loss of 10-20 % in the wine that might have been produced if the pressing had been complete.

At the present time, the use of the wine press appears to be increasing and it is to be hoped that in the near future it will be universally employed throughout the country, even in the more remote districts. The wider distribution of the press, which the Serbian cultivators were learning to appreciate, was stopped by the war, when a large quantity of the wine plant was destroyed and many people ruined.

Another serious defect is the inferior quality of the wine vats, which are not kept in proper condition. A large number of vats were destroyed during the war and have not yet been replaced. Those which remain consist chiefly of casks holding 10-50 hl. The small proprietor is often unable to fill the cask entirely and naturally the wine is spoilt and turns sour. There are no doubt certain proprietors who are properly careful of the condition of their vats, but the peasants are apt to neglect this duty. In the villages the empty vats are left in the open or under rough shelter, throughout the winter, spring and summer, until the following vintage. Consequently they become dried up and mouldy.

In 1874 Savic wrote :— " My throat becomes dry when I drink the common wine, the disagreeable flavour of which is attributed by the producers to the taste of the soil and not as it should be, to the defects in the wine vat ". He also stated that " the Serbian wine drinkers do not distinguish between the acetic acid and the tartaric acid flavours " and that " it is necessary to start at the beginning with the education of the taste of the consumer ". This is only too true and his observations hold good even today.

" Our people do not expect good wine and do not show any refined taste, in their choice", says the agricultural scientist Velitsckovic (*Tèjak*, No. 5, 1923). It appears that the wine in request by the ordinary buyer must always be cheap and that the difference in price between a pure wine and a thick or sour wine is insignificant. There

is therefore no particular encouragement to produce good wine and to use better methods of conservation. The fact that certain improved methods have been employed with success with some native wines, indicates the possibility of producing an agreeable wine, if modern technique is followed. Very little bottling is done and filtration and clarification which have been in common use for a long while throughout Europe is only practised in Serbia by a few wholesale merchants in Belgrade.

With a view to the general improvement of vine cultivation and the wine industry in Serbia, the Government has during the last few years initiated a scheme which includes the following :

(1) The establishment of nurseries as mentioned above which are, however, still only in the early stages of formation.

(2) An increase in the number of agricultural schools and special courses.

(3) An increase in the number of State agricultural officers which is, however, still very limited including only 38 provincial and 167 district officers, *i. e.* 1 for every 21 112 inhabitants. Amongst the existing State agricultural officers very few have had special training in viticulture and oenology.

(4) In 1923 the first oenological experiment Station was established at the agricultural college at Bukovo, for the analysis of wines and soil and the study of all questions relating to vine growing and oenology in the country.

The working out of this plan is only in its early stages and the development of oenology in Serbia on scientific lines of technical and economic organisation remains a long and difficult business.

" Hitherto much less has been done in Serbia for improvement in the wine industry than in viticulture itself. In the first place, there are very few institutions for training specialists and very little modern plant ". (VELITSCKOVIC, 1923, *Ibid.*). Such is the opinion of an expert who goes on to say : " Most of our wine growers prepare the wine empirically without any knowledge of scientific methods. Hence there are as many types of wine as there are producers ".

SAVIC in 1874 and VELITSCKOVIC in 1923 were both agreed as to the best method to be adopted for developing the Serbian wine industry, and its proper organisation so that it may become an important feature in the national economy and the export trade of the country :

(1) Firstly it is desirable that the vine growers should form

Societies with co-operative cellerage and storage under the charge of experts. This association should provide members with the necessary modern equipment of good quality at reduced prices. At the present time a certain number of vine-growers societies known as " Zadrugi " are working successfully *e. g.* at Smederevo, Venciatz and Arandjelovatz, etc.

(2) Development of Experiment Stations and wine testing laboratories.

(3) Improvement in the taste of the consumer and the need of familiarising him with good wine.

(4) Popularisation among wine growers of modern methods of preparation and conservation of wines.

(5) Increase in the number of instructors and œnologists.

(6) Legislation against the adulteration of wines and prohibition of the sale of adulterated or deteriorated wines.

It is in this way only that Serbian wines can eventually take the place that they merit in the national economy through their good natural qualities and the importance of the production.

Steps should also be taken to encourage exportation as well as the general use of the wines in the country as valuable and wholesame beverages and perfectly harmless. At the present time, the consumption of spirit made from grape skins and plums is widespread and the cause of alcoholism.

Serbian wines cannot be said to be of any set or constant type. Wines have been put on the market with the same designation of origin which may at different times be rough and strong, acid and light, or sweet and scented, and sometimes again adulterated or sour and almost invariably thick. This is certainly not doing proper justice to the possible wine products of Serbia such as they would be if modern technical methods and knowledge were used in the treatment of its excellent grapes as has been the case for many generation in the rest of Europe but which are so far so little known in Serbia. If these lines, were followed, Serbia could produce its own distinctive wines :— sufficiently alcoholic, light, refreshing, with some body and of good colour which although not capable of competiting with the best wines of Europe and the well known brands, would at least provide a good a table wine which would be appreciated both by local consumers and for export purposes. Conditions are not favourable for the production of strong sweet wines, except perhaps in Macedonia. Hence it is not likely that much encouragement

will be given to the production of natural sparkling wine in Old Serbia where the soil is a heavy clay. But in the writer's opinion, the production of cognac which up till now has been neglected, should become distinctly important as the natural conditions appear to be exceptionally favourable and the low priced acid and light Serbian wine is particularly well for adapted this branch of production. Here too the application of modern methods in distillation would be highly advantageous.

According to the results obtained by the writer at Smederco, an average of 11 to 11.5 " grades " of alcohol was obtained in 1921 and 9.5 " grades " in 1922 which was an exceptional year as regards rainfall and early autumn frosts. The tartaric acid content in the new wine was 8-11 ‰; the average for Serbian wines was from 8-12 " grades " of alcohol, according to the district, usually 9-10 and only for the better qualities wines up to 11 or 12 the wine made by the vine growers themselves is never higher than 7-8 grades. Taking into account the limited exportation of Serbian wine, which has decreased during the last few years as is shown in Table II, and the high yield the trade question presents special difficulties. The value of the *dinar* (about 9 ½ d at par), has decreased considerably during recent years. The cost of produce and goods in general has risen, but the cost of wine has considerably decreased. After three successive years of high yield (1921-23) the wine market was overstocked and the competition of the superior wines from Dalmatia and the ex-Hungarian provinces has also proved a decided hindrance to the sale of Serbian wine.

The principal types of Serbian wines, named according to the district where they are grown : are : Yeliscko, Giupsko, Venciatsko, Nisćko, Smederevsko, Kragunyevatscko, Krainsko (Negotinsko), Pogiarevatscko, Kavadarsko, Tikvesko, etc. The chief centres of the wine trade are Belgrade, Alexandrovatz, Negotin, Smederevo, Kavadartzi, Skoplié.

III. Vine Cultivation and the wine industry in the new provinces of the Kingdom of the Serbs, Croats and Slovenes.

In the annexed territory which was formerly part of Austria-Hungary, vine growing and the wine industry are widespread and more progressive methods are followed than in Old Serbia. The

Vines in Jugo-Slavia.

FIG. 55. — Ranka, Pink (native variety).

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Vines in Jugo-Slavia.

FIG. 56. — Verius (Native variety).

PLATE XXVIII.

Vine in Jugo-Slavia.

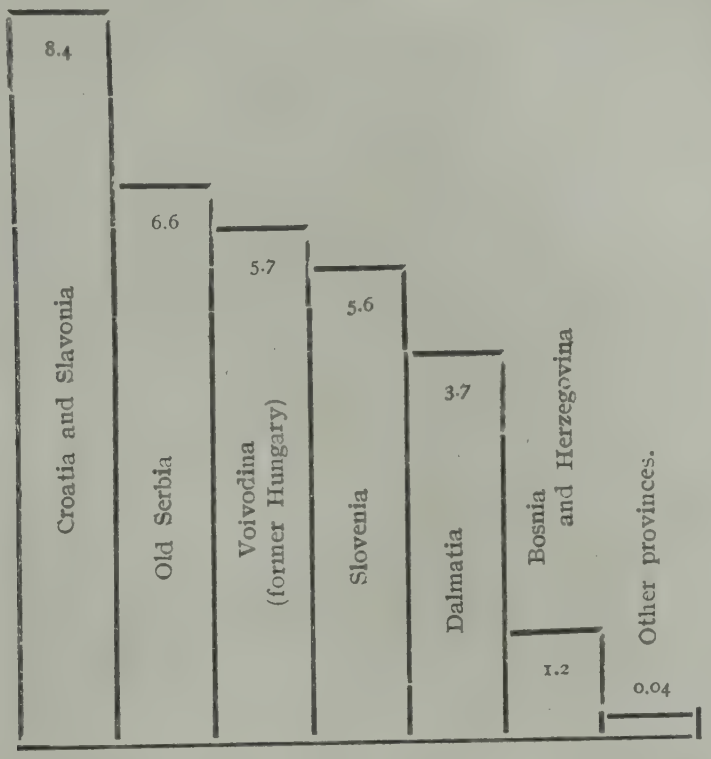
FIG. 57. — Hamburg Muscat.

Vines in Jugo-Slavia.

FIG. 78.—Malaga Muscat, Black.

diagram below shows the rate of production in hundreds of thousands of hectolitres, in the various provinces of the Kingdom.

Distribution of Vineyards in the Kingdom of the Serb-Croats and Slovenes.



In the territory formerly belonging to Austria-Hungary good sized vineyards are to be found with sufficiently well equipped cellars, where the vats are well looked after. The vines themselves, including those on the smaller estates, are mostly selected and acclimatised varieties such as Riesling, Traminer, Semillon, Pinot, Silvaner, Mourvèdre, Cabernet etc. which are for the most part grafted on American stocks. Attacks of phylloxera are of recent date and occur chiefly in Slovenia and Dalmatia ; the work of re-establishment has been quickly carried out. Single varieties are cultivated and not different varieties indiscriminately. Cultivation and pruning are performed with care and there are many excellent specialists especially among the Croats and Slovenes. In Croatia a special vines inspection service has been organised to instruct the vine grower and to see that the work in the vineyard and cellar is regularly carried out. The Schools of agriculture and oenology are well organised, but their number is still inadequate. There is a Faculty of Agriculture at the University of Zagabria ; a middle school at Krigievtzi and another was established

at the end of 1922 at Maribor and there are also nine lower schools. At Butinir (Bosnia) there is an experiment Station with practical courses. Wholesale merchants often make use of the œnological Laboratory at Zagabria and Lubiana for the analyses of the wines which they have purchased. There is also an œnological experiment Station at Zagabria.

The large cellars allow the wine to mature for 2-3 years and bottling is the common practise. The type of wine from each particular region is more clearly marked than in Old Serbia, but the distinctions are not yet absolutely defined. The wine press and crusher are in very general use, even in the villages, and clarification and filtration are recognised practices. In the larger cellars before bottling, pasteurisation is often carried out. The wines of Mostar (Herzogovina), Gilawka, Blatma, Suvarak, are preferred in the Belgrade market to the Serbian wines and their price is one and a half times higher. Wines from Voivodina also enter into competition; they are sold at a low price and are of better value in spite of lower strength in alcohol (8-10° Mall.) than the best wines of Old Serbia. In Belgrade, these are the only wines sold in bottle ; they are chiefly for table use with a characteristic flavour and good colour of medium strength and pleasant aroma.

When reference is made to wines which are used in the first few years there is no reason to speak of the " bouquet ". The average alcoholicity is from 8-13° Malligand ; for the smaller vineyards 8-10° ; for the larger estates 10-13°. Voivodina supplies white wines at 8-11° Mall. at a very reasonable price. Red wine scented with sweet-smelling herbs and sweetened, of the Bernet vermouth type is popular in Serbia and is made chiefly at Karlovci in Sirmia. The red wines of Dalmatia command a higher price than Serbian wine, they have an alcoholic strength up to 16° Mall., and are distinctly aromatic.

The principal wine markets in these provinces are the following ; in *Slavonia*, Brod, Pozsega, Giakovo, Slatina ; in *Slovenia*, Maribor, Ptuj (Pettau), Ljutomer, Radgonia; in *Croatia*, Zagabria, Krigevtzi, Vaska and Varajdin ; in *Voivodina*, Karlovli of Sirmia, Bela-Tzrka ; Vrchatz ; in *Herzegovina*, Monstar ; in *Dalmatia*, Spalata, Sebenico, Bolnabatscin.

The oldest and most advanced vine growing region among these provinces is Dalmatia, where the vines cover 6.4 % of the total area of the province.

The wines of Dalmatia were exported to Italy as far back as the XVth century and were celebrated throughout Europe. Dalmatian vine growing had a special period of prosperity especially from 1878 to 1890 when France, owing to the ravages of phylloxera in her own territory, began to purchase the larger quantities of wine from Dalmatia which caused the price to rise ten fold. The whole of the coastal area and the islands were covered by a continuous series of vineyards. In successful years the Dalmatian yield amounts to 1.5 millions of hectolitres — and in 1923 it was 750 000 hl. The wine industry is the chief occupation of the inhabitants.

Recently, considerable damage has been done by phylloxera and re-establishment of the vines is being effected, American stocks being used for grafting. There has been no rise in the export trade in wines during the last few years, but a distinct falling off. The following are among the causes : the uncertainty in exchange rates ; interruption of commercial relations during the war period; taxation and customs difficulties ; high price and delay in transport service which is also poorly organised. Before the war Dalmatia exported its better qualities of wine chiefly to Austria and Italy ; at the present time there are no exports to Austria and very little wine is sent to Italy.

In order to remedy the present conditions the Government has drafted a series of regulations, which, however, have not yet been put into operation, to the serious detriment of the export trade in wines.

The co-operative wine making movement makes very little headway in these provinces. Co-operation is, however, well represented by the agricultural associations which bring together all branches of agriculture and are in the main societies of consumers.

The development of production and the organisation of the export trade should eventually make it possible for these provinces to export wines to the neighbouring countries which have no wine production. By improving technical methods it should also be possible to obtain a type of table wine of good flavour and if not of the highest quality, at any rate pure and wholesome and coming from a district exceptionally well suited for vine culture both as regards soil and climate.

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FORMALISM IN BREEDING OF LIVE-STOCK AND MODERN RESEARCH ON HEREDITY.

The characters to be aimed at in breeding have for the most part been settled by experts at fairs or shows, but frequently competition has played a decisive part in directly encouraging breeding for certain economic qualities. There is no doubt that the rivalry between breeders of butchers' beasts has greatly contributed to the development of the present type of cattle in England.

Further, competition has been the cause of fixing a certain coat-colour, or the position of the horns as characteristic of a particular breed. This desire for uniformity has had the unfortunate result that domestic animals which do not conform to the standard, especially as regard coat-colour, are often slaughtered, although not all the individuals were destined for breeding purposes.

In the case of horses, however, all the foals are kept, and therefore the tendency to uniformity is not so marked as in other live-stock, except in certain instances, where matched animals are required which justifies severe measures being adopted to insure uniformity.

In sheep-breeding, rigorous selection is practised with the object of obtaining a white fleece, which is of real economic importance, since white wool dyes more easily than coloured wool.

The sheep-breeding industry has, however, suffered from formalism, to which must be attributed the demand for a black muzzle in white Cheviots and although in spite of selection for many years, lambs with white muzzles frequently appear, this deviation from the accepted standard is considered of such importance that when a white-faced lamb is dropped by a Cheviot ewe, the fact is duly registered in the Flock-book. Indeed I have seen flock-books in which the colour of the lamb's face was the only character entered. Black patches on the ears and legs in the Cheviot breed are looked upon with disfavour.

The thick covering of wool which is *de rigueur* on the head of Shropshires and many Merinoes often interferes with the sight of the animals as the wool comes over their eyes.

In our country, there is some reason in requiring that pigs should have a white coat, for the consumers often object to a dark skin, but in southern lands, pigmented swine are superior to others because they resist the sun better. Pure formalism as regards colour has however, prevailed in some cases, since only the standard coat-colour is admissible in Berkshires, Poland-Chinas etc.

The long, pendant ears of many of our native breeds of pigs are another instance of the tendency to formalism

The Large Yorkshire should have a long, slightly turned-up snout, and long erect ears. These characters appear to be a heterozygous combination, for among the pigs of this breed there occur very frequently types with either the short snout of the Middle Yorkshire, or the long snout and pendant ears characteristic of the native swine.

This strict adherence to various standard points may have great disadvantages in the breeding of sheep and pigs and may exclude the use of breeding animals possessing the most important economic characters, although since these animals grow very rapidly, and the number of individuals from which to select is large, formalism does not exert such a deleterious influence from the economic standpoint as in the case of other live-stock that develop more slowly and whose sexual maturity is consequently later.

The formalist school has, however, applied its theories especially to large live-stock of slow development. The colour and pattern of the coat have been regarded as of paramount importance, so that at no time has a selected animal of the Plains breed of Pied cattle been awarded a prize, or entered in the Herdbook if its legs showed the smallest black patch upon their white surface.

Indeed, in Holland the cows are sent at calving-time to a province where irregularly marked calves are eligible for registration in the herdbook.

The Hereford is a breed in which coat-markings are regarded as of great importance. These cattle should have a white head, chest, and belly, white legs and tip to tail, while a white line runs along the back of the neck. For at least 70 years, this breed has been selected in order to fix these particular coat-markings, but in spite of Pitt's researches, homozygous markings have not been obtained even in the best lines, and calves are regularly born with too much white about them.

In the case of the Pinzgau cattle at Salzburg, as well as in that

of our Telemark breed, certain coat-markings are required, and are in fact obtained, although individuals deviating from the type occur from time to time. Very regular coat-markings are insisted upon for Pinzgau animals but the presence of too large a proportion of white is an habitual rule, in spite of selection being directed towards the standard type. In the Telemark cattle, the thigh had formerly to be coloured, small patches on a white ground being regarded as a deviation from type ; but both these types of marking are found in the progeny of pure-bred individuals. The present Director however of the Telemark Stock-Breeding Station no longer insists on self-coloured thigh in these cattle. An amusing instance can be cited of the manner in which a typical breed colour has been obtained in Norway. Both cross-bred and pure-blood Ayrshire were generally kept at Trondelangen at the beginning of 1890. At that time, there was a great cattle breeding movement in Norway, and the Director of Trondelagen did all in his power to discover a local type as well as a national type. The first stage was the creation of the grey-coated " beitstad " animal, but as this colour did not prove satisfactory, the Director set to work to obtain from the Ayrshire breed and its crosses, cattle with a uniform red coat. The sire of this " local " type was a red, homozygous Froita bull whose progeny were all self-coloured.

This local evolution of breeding in Norway brought in its train a number of special colour requirements.

Of these the most characteristic is the demand for exclusively grey-coated cattle in the Province of More. This uniform grey colour is due chiefly to a dominant decoloration factor changing black into grey, deep red into pale red, and light grey into white which means a deviation from type. If, unfortunately, a heterozygous bull should make its appearance in this province, it might happen, since the quality of some of the colour factors is sufficient, that from small herds of 6-10 cows not a single heifer calf of the coat-colour required by the Director of the Stock-Breeding Station would be obtained.

The colour of the muzzle is also a very important breed character. Shorthorn cows must never have a slate-coloured muzzle ; this character excludes the animals from the Herdbook in Germany while their registration in Denmark is a matter of considerable discussion.

Formalism has not only greatly extended its influence in determining coat colour for we find that practical authorities on cattle breeding have also turned their attention to the horns and their position.

In Germany, appliances for giving horns the required shape have been advertised. The bony excrescences occurring in hornless breeds are not appreciated and in Norway, cows with these rudiments sell for lower prices than others.

As regards the external conformation of cattle, many points are required in Show animals, but the balance is kept between the purely formalist and the wholely utilitarian standpoints. A well-formed udder is of practical importance. But it would not be justifiable to lay too much stress upon this character. Many of the external characters required in Show animals are of no practical importance, and the disfavour with which a sloping croup in cattle is regarded appears unreasonable.

As regards milking characters, the question appears to be settled to a certain extent since GOWEN's researches, for cows are regarded solely from the dairy point of view. No study has been made of milking characters in bulls, but it seems unlikely that any character in the sire should influence the milk yielding capacity of its female progeny.

It can well be understood that before the laws of heredity were known, much economic importance was attributed to the external characters of domestic animals. Now, however, on the contrary there is no reason to preserve the formal characters of the breed, because we know that the chromosomes are the bearers of heredity in the case of all living organisms, and that this heredity in any given species is more complicated in proportion as the number of chromosomes increases.

The number of pairs of chromosomes present in the following domestic animals is: pigs 20, large cattle 16-17; horse 19, but these figures are increased by the possible combinations, which, in the case of swine, are most numerous and varied.

In our domestic animals, there are so many important economic characters to be discovered by selection and these characters depend upon such a large number of hereditary factors, that it is impossible for the breeder to pay attention to any qualities not having great practical importance. The only reason justifying selection directed to obtaining a character of no economic value would be the hope of discovering a combination of hereditary factors that would in its turn give rise to an important economic quality. The only means of discovering such a combination would be to adopt the methods of ARENANDER in his researches on the functional characters

of hornless cattle as compared with those of horned cattle. As, however, his work is by no means free of bias, it does not merit further mention. On account of the large number of chromosomes possessed by our largest domestic animals, it is very unlikely that sufficiently powerful combinations will be found to be of any practical tility.

The modern doctrine of heredity shows clearly that the method adopted for the elimination of recessive, atypic breed characters is quite useless. Refuge has been taken in killing, or excluding from breeding, all animals that do not reach the required standard.

In most of these instances of formalist selection, the difference between the typical and the atypical individual depends upon a single hereditary factor, so that it is possible to calculate how quickly the number of recessives can be reduced as soon as these are excluded.

Suppose that there are in a herd at first $\frac{1}{4}$ dominant homozygous (pure) individuals, $\frac{1}{2}$ dominant heterozygous (impure) individuals and $\frac{1}{4}$ recessives, the number of the recessives will decrease in geometrical progression, and in the first generation, the proportion of recessives will be $^1/_9$ in the second $^1/_{16}$, in the third $^1/_{25}$ etc. (1).

The number of heterezygous individuals will in its turn fall in the same proportion being in the first generation $^4/_9$ in the second $^6/_{16}$, in the third $^8/_{25}$ etc. (2).

This, however, supposes that the pure and the impure dominants have the same chance, but this is practically not the case. "Matadors" occur naturally amongst both the pure and the impure dominants. It must be remembered that in this combination if both the pure and impure had the same chance, the latter would be reduced to 15.3 % in the 10th generation, provided all the recessives had been eliminated during this time. Even in the 10th generation it is possible to meet with a "Matador" that is heterozygous as regards the factor in question, and then the results of the preceding selections are soon lost.

We have in Norway, two striking instances of the manner in which Matadors have rendered abortive efforts to obtain uniformity.

(1) The formula for calculating the number of recessives is as follows: $\frac{1}{(p\,n+2)^2}$ . . . n being the number of generations.

(2) The formula for the number of heterezygous individuals is $\frac{2\,(n+1)}{(n+2)^2}$ . . . n being the number of generations.

Formerly, it was required that all horses in the eastern districts should have either a black, or a brown coat. This goal had been almost reached because " Dalegudbrand 446 " and " Draupner 613 " were two black Matadors in which the hereditary factor for red was lacking. The triumph was, however, of short duration.

" Draupner " sired " Brimin 825 " which possessed the factor for red and thus the resistance to this colour was broken.

Colour transmission in the Aberdeen-Angus breed may be cited as an instance where the troublesome recessive factors have not been got rid of, even by the elimination of the recessive individuals. For at least 50 years, a selection of entirely black individuals was carried out within this breed, but according to WATSON, red calves, or calves with the objectionable white spots on their legs, were of frequent occurrence.

Naturally, it is possible to obtain a breed homozygous as regards the dominant hereditary factor required, provided all individuals that are heterozygous for the recessive hereditary factor are eliminated, but no-one would like to take upon himself the responsibility of rejecting a breeding animal with a good hereditary record of important economic qualities, even if it were heterozygous for an hereditary factor of no practical value.

It is quite certain that if the breeding authorities were for instance, to exclude from the Herdbook and refuse prizes to all cattle producing a red calf, such calves would very rarely make their appearance in that breed. The struggle against characters depending upon hereditary recessive factors is, and will remain, fruitless; therefore there is no reason in burdening the practical breeder with the expense entailed.

It is different where we have to do with characters depending on hereditary factors that have proved to be more, or less, completely dominant. In this case, it is possible to eliminate entirely all undesirable characters, although great injury may be caused if this elimination is pushed to undue lengths. We are well aware from the study of the origin of the various breeds that the individuals forming the original stock and maintaining the breeds were few in number and that some of them may have been the offspring of animals possessing an undesirable hereditary dominant factor. The English race-horse is a striking example of this possibility and affords an instance of the manner in which a stallion possessing a rare dominant character can transmit this character to its descendants. " Te-

trarch ", a stallion with a dapple-grey coat (due to absence of pigment), sired foals that were classed among the first on the list of prize-winners, while one actually carried off a first prize. The dapple-grey coat which depends on an hereditary dominant factor was very uncommon among English thorough-breds in the time of " Tetrarch " but a " Matador " with this coloured coat was, however, produced by them.

As regards the characters dependant on hereditary factors that are more or less dominant, and have no direct economic importance, they should perhaps be carefully eliminated.

Modern researches on hereditary and on the origin of zootechnical breeds clearly show that in the case of breeding domestic animals for utility purposes we are unable to choose characters that do not possess a direct, or indirect economic importance.

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THE PREPARATION OF HAY BY MEANS OF COVERED SILOS OF THE CREMASCAN TYPE.

Historical Notes.

The first published account of burying forage in pits, or trenches, that we have so far met with (1) is to be found in a work written in 1786 by Prof. John Symonds (2) of the University of Cambridge (England), which refers to studies made in Italy on the use of leaves in the feeding of live-stock in the following terms: "Of the various kinds of winter forage used in Italy, leaves are some of the most important, but considerable care is necessary to keep them in good condition. The leaves must be gathered in September, or the beginning of October, during the hottest hours of the days. They are then spread out to dry in the sun for 3 to 4 hours, after which they are placed in wooden boxes, subjected to great pressure, and finally covered with sand, or else buried in a trench over which strawis spread, the whole being covered with sand and clay."

The practice of silaging forage therefore possibly originated in Italy, and certainly the Italian farmers, though they possessed no silos, well understood the principles governing the systematic conservation of forage in silos, viz.:

1) Partial drying of the forage; 2) exclusion of air.

From Italy, the practice seems to have extended to France, England, Germany and America. The box and the primitive trench have now been transformed into receptacles on the surface of the ground and made of masonry, cement, or sometimes wood, but the general structure of the silos has never been altered and forage silos have always been open.

In practice, however, the results obtained have always been uncertain when the silage was of a delicate grass type, no matter whether the sweet silage, or acid silage method was adopted, for the product was always too acid, and thus if fed exclusively to stock,

(1) *Silos, Ensilage and Silage*, Manly Miles, Orange Judd Company, 1918, New York.

(2) *Young's Annals of Agriculture*, Vol. 1, p. 207.

proved injurious; further, it was impregnated with the characteristic and unpleasant smell of the silo.

On the other hand, when this method was adopted in the case of coarse forage, especially in that of maize, or leaves, excellent results were obtained. In America, where as a rule, only maize is silaged, the number of silos has risen to hundreds of thousands the number of farms now using them being 900 000 as against 300 000 (Statistics of 1916).

The Silo.

The Cover. — Silos in Europe are, as a rule covered, when full, with a kind of lid made of earth, or other heavy substances with, or without, wooden beams at the bottom.

In America, on the other hand, the idea of constructing high, narrow, tubular silos has made it less necessary to cover the silo with earth, or some similar substance, and owing to the high cost of labour it is more economical to let about one metre of silage rot, rather than to incur the expense of carrying heavy materials to a height of fifteen, twenty or more metres.

Carbon dioxide. — Carbon dioxide is regarded as the chief factor of the good conservation of forage in the Cremascan type of silo.

This gas is always produced in large masses of forage, whether the herbage is quite dry, entirely fresh, or partly dried, and has the same value in the silage process as alcohol in the fermentation of wine.

The phenomena giving rise to carbon dioxide are almost identical in the fermentation vat and the mass of forage, but whereas in the fermentation of the must, it is the alcohol that checks and arrests fermentation, in the so-called dry fermentation of the forage (which is produced by the intercellular respiration of the plant tissues that are obliged to live without contact with the oxygen of the atmosphere), the carbon dioxide regulates and stops the process. Therefore the principal aim in the Cremascan type of silo is to obtain the maximum utilisation of the carbon dioxide.

This gas is not respirable by plants any more than by animals, although naturally the latter are more sensitive to its presence.

Plants are not killed by carbon dioxide unless the percentage in the air rises to from 20 to 40 %; smaller amounts only impede their vital functions. Indeed, 10 % of CO_2 has a beneficial effect upon the conservation of forage in silos, since it reduces the heating of the mass and prevents the development of moulds.

Bottle Silos. — The good effect of CO_2 upon the conservation of forages in silos was clearly proved by the following experiment: partly dried grass, still retaining 30-40 % of moisture, when introduced into a wide-mouthed white glass bottle closed with a rubber stopper was found to keep excellently. No moulds or putrid fermentation developed, as the air was charged with carbon dioxide. The same phenomenon is repeated, but to a varying extent, in any shape of silo.

Large quantities of this valuable preservative gas escape, from the silos of the type we will call European, viz., of the primitive Gorfard type which are only 4-5 metres high but large and square. In Table I are given the data of three silos of the above type filled with grass (fourth cut from neighbouring meadow) during the first sixteen days of fermentation.

Table I. — *Amount of Carbon Dioxide accumulated in the Silo.*

Days of storage in silo	% CO_2 in the air of the silo		
	Silo I	Silo II	Silo III
1	23	17	30
2	35	27	42
4	29	33	45
8	31	33	29
16	25	31	32

Thus the amount of CO_2 that escaped never exceeded 40 %. In Table II, the data refer to the Cremescan type, with impermeable cover, and filled with fresh grass:

Table II. — *Accumulation of CO_2 in Silos of the Cremascan Type.*

Days of storage in silo	% CO_2
1/2 (12 hours)	25
1	50
2	70
3	75
4	78
5	82
6	82
7	85
8	84
9	86
10	87
11	88
12	90
14	90
16	91

Therefore in the Cremascan type of silo, the carbon dioxide increases gradually and continually beneath the cover. This constitutes the superiority of silos with gas-impermeable covers over the old type of silos whether American, or European.

Fig. 59 shows the working of these three types as regards the accumulation of carbon dioxide.

FIG. 59. — Accumulation of Carbon dioxide in the three types of silo: Cremascan (top curve American (middle) and European (bottom).

HEATING.

In silos with covers, the CO_2 stops the vital processes of the cells, thus preventing any rise in temperature in the mass.

The fact that no rise of temperature takes place is one of the special characters of our type of silage process; it has been ascertained that no heating occurs in a mass of green fodder packed into the silos provided with covers. In the case of some of the first of these silos made in 1913, and used at the Agricultural School of Orzivecchi (Brescia), the temperature of the forage on the day it was put into the silo (at the beginning of November), was 10° C. and did not rise,

indeed, it fell slightly owing to the winter temperature, during the three months it remained in the silo.

The high percentage of CO_2 on the one hand and the absence of any heating on the other are very important factors for the good conservation of forage. Acid bacteria and ferments, however, develop freely in the presence of this gas when the forage has been put quite green into the silo. Under this condition, the cell-sap exudes from the plant tissues under the action of the pressure exerted in the interior of the silo. The cell sap of forage is itself acid and forms a suitable medium for acid-forming ferments in general. As a result of acid fermentation, the sugars almost entirely disappear, as is seen by the figures (Table III) obtained from bacterial analyses made for the purpose of estimating the decrease in the sugars of forage siloed while still green.

It was, however, found that although the bacterial fermentation was in no way interfered with, yet since the activity of the life-processes (intercellular respiration, etc.) were reduced, all the sugars did not disappear. In the case in question, the loss amounted to 51.41 %.

TABLE III. — *Decrease in sugar and development of micro-organisms in fresh grass stored in a Cremascan silo.*

	Percentage of sugar (glucose)	No. of bacteria per gm.	
		Gas-generating	Non gas-generating
Grass at time of storing in silo	1.24	8 000	40 000
After 1 day »	1.22	50 000	1 000 000
» 2 days »	1.09	1 500 000	8 000 000
» 4 » »	0.80	120 000 000	400 000 000
» 8 » »	0.72	150 000 000	600 000 000
» 16 » »	0.70	70 000 000	100 000 000
» 1 month »	0.65	10 000 000	50 000 000
» 2 months »	0.68	9 000 000	30 000 000
» 3 » »	0.65	10 000 000	30 000 000

In covered silos, since it is possible to treat half dried forage, this acid-generating fermentation, which also destroys useful substances, can be wholly eliminated.

The old type of silo was always filled with green (living), though slightly withered grass, in order that the intense fermentation should prevent any putrid fermentation.

In a Cremascan silo, where all the preservative action of the car-

bon dioxide is called into play, forage with a low moisture content and kept under conditions wholly excluding bacterial fermentation, can safely be siloed. This fermentation, however, only occurs when nutritive substances exude through the cell walls. But if the moisture content is reduced 50 % by drying, no such substances can come from the half-dried cells, even under the intense pressure produced in the silo. The number of bacteria present in a silo filled with partially dried grass which has lost 50 % of its moisture content is therefore almost nil as can be seen from the data given subsequently.

In such forage, however, not only is bacterial fermentation diminished, but the biological phenomena are reduced to their lowest terms, since the partial drying of the cells lowers their vital activity, and at the same time, the depressing effect of the CO_2 is more intensely felt.

Thus, in proportion to the decrease in the vital force of the forage there is a corresponding fall in its acidity and in the consumption of the sugars after the months during which the forage is normally kept in the silo, as is seen by Table IV.

TABLE IV. — *Loss of moisture, acidity and sugars and development of micro-organisms in hay silage.*

	Loss of moisture %	Loss of acidity %	No. of micro-organisms per gm.	Loss of sugars %
After 1 day's treatment . .	12.00	0.54	2 000	12.3
» 2 days' » . . .	12.33	0.65	2 000	19.9
» 4 » » . . .	29.11	0.70	3 000	21.1
» 8 » » . . .	40.62	0.71	8 000	26.2
» 16 » » . . .	53.24	0.82	30 000	32.4
» 1 month » . . .	61.63	1.60	40 000	45.4
» 2 months » . . .	69.20	1.83	60 000	49.2
» 4 » » . . .	78.90	1.96	100 000	51.41

PROTEIN SUBSTANCES.

When partly dried forage is silaged, no changes due to the life-processes taking place in the mass occur in the protein substances, as has been ascertanied by our repeated analyses. Even if quite fresh grass is put into the silo the protein substances are but little attacked as is shown by the following Table.

TABLE V. — *Breaking down of the protein substances present in green forage silaged in a covered silo.*

	Total Nitrogen %	Precipitatible Nitrogen (Stutzer) %
After 1 day's treatment	0.728	0.340
» 2 days' »	0.728	0.371
» 4 » »	0.730	0.340
» 8 » »	0.727	0.339
» 16 » »	0.731	0.344
» 1 month's »	0.728	0.352
» 1 months' »	0.727	0.360
» 4 » »	0.730	0.369

On estimating with Stutzer's solution the percentage of insoluble nitrogen that has gradually become soluble during the 4 months the forage has been in the silo it is found, taking as a basis the above figures, that only 3.99 % of the protein substances have undergone retrogradation, which is very little when compared with the 10 to 30 % of the protein matter that is broken up when the old type of open silo is used.

Therefore with covered silos, it is possible, in the case of partially dried forage, to conserve the silage without losing more than a portion of the total sugars and with no alteration in the protein substances.

The silage produced in these silos possesses nearly all the organoleptic properties of hay properly so-called, and has a very pleasant smell, while it has the following advantages as compared with ordinary hay.

ADVANTAGES OF SILAGE HAY.

I) No flowers, or leaves are lost, for the partially dried grass does not shed its delicate and most nutritive parts (stalks, leaves and flowers) many of which often remain on the ground when the hay is allowed to become quite dry.

II) Silage hay is more digestible than other hay for it is in a soft condition, owing to its high moisture content (30-35 %), whereas the percentage of moisture present in ordinary hay is only 12-14 %) and is therefore better masticated and ruminated by cattle.

III) For the above reasons, hay silage although richer in moisture than ordinary hay has only a slighter lower nutritive value.

FIG. 60. — Tubular silo of the Cremascan Type in reinforced concrete with "ballatoio" (gallery).

and thus has the great advantage of *increasing the profits by at least one-third*. In fact, 100 kg. of grass or eighteen to twenty kg. of ordinary hay (which is about the ration for a full sized dairy cow) would make on an average thirty to thirty-five kg. of silage, or 1 ½ rations for adult cattle which normally consume twenty to twenty-five kg. of hay silage. Hence, a certain saving of 30-40 % can be effected by using hay silage.

IV) Hay silage requires less labour than hay, therefore fewer workers are employed which reduces the wages-bill by at least one-third.

V) The forage suffers less injury from atmospheric conditions, as it remains a shorter time on the field, and is less exposed to rain. Further, even if it is wetted, the damage done is less, for the forage is at that time always in its first drying period.

VI) Early and late cuts can be used that could not be made into hay, and therefore the agriculturist has more liberty in the choice of the time to cut his forage.

VII) Hay silage does not leave débris because being soft, the tissues are elastic and the flowers and leaves do not break off and fall. Much less does it produce dust, which is very injurious to all animals, and to horses in particular, for it causes cough and irritation.

VIII) Since silaged hay is subjected to great pressure, the same cubic space contains three or four times more by weight of hay silage than of ordinary hay which effects an economy of storage room.

IX) Finally, hay silage not being liable to combustion, cannot set fire to the silos, if these are made of masonry, or reinforced concrete. For all these reasons, the cost of silage construction has always been paid off in a few years, generally in two or three, but in some very fortunate instances, even the first year of use.

Construction of the Silos.

The adoption of a gas-impermeable cover in the Cremascan type of silo, has been followed by a further innovation viz., the compression of the cover. At first, this pressure was obtained by means of an attachment screw, by which the silos were turned into great presses with the screw in the centre while the pressing-off

screw exerted its force above the cover by means of an arrangement of beams and boards.

This method, however, which was employed in the first mechanical pressure silos that were tested experimentally in 1912, and used practically for the first time by Conte Gaddo Vimercati Sanseverino of Crema (August 1913) has the great disadvantage of being very difficult to carry out. It was necessary during several days of the first period of treatment for a man to work the compressing screw, which entailed considerable trouble on a farm. Afterwards, the pressure was obtained from weights, this system being practised for the first time by Cav. Luigi Allocchio of Crema. These weights are piled upon the cover during the last period of treatment. In order to facilitate the transport of these weights which are very heavy in the case of large silos (as is shown by our photographs), 70-80 quintals per 3-4 square metre of cover surface, a so-called " ballatoio " was made in the silos, which collects the weights that are to be loaded on to the cover of the silo. The " ballatoio " gives to tubular silos of the Cremascan type made in reinforced concrete the special shape shown in the photograph reproduced in fig. 60. The Cremascan type of silo is being rapidly adopted in different parts of Italy. The Travelling Schools of Milan, Parma, Salerno, and Udine have published propaganda pamphlets, and the Ministry of Agriculture has announced a competition. Many industrial firms make a speciality of this particular kind of silo.

There are over a thousand Cremascan silos at present working in Italy. The good reception they have met with from agriculturists is essentially due to the fact that the product leaving these silos is never ill-smelling and acid, such as is produced in the old type of silo if forage of the " grass type " is silaged, but possesses all the characters of ordinary hay. For this reason, Cremascan silos are no longer used for making acid forages, but are employed for the preparation of a special kind of hay.

Franco Samarani,

Director of the Experiment Station of Agricultural Bacteriology, of Crema.

AGRICULTURAL INTELLIGENCE

AGRONOMY.

Soil Science.

305. **Solubility of Limestones as related to their Physical Properties.**

MORGAN, M. F. and SALTER, R. M. (Ohio State University). *Soil Science*, Vol. XV, No. 4, pp. 293-305, 3 figs. Baltimore, Md., 1923.

The authors conclude that with particles of the size ordinarily found in agricultural ground limestone there is no apparent relationship between the rate of solubility in acid soils and any physical property of the rock material. The rate of solubility is very largely influenced by the relative amount of magnesium carbonate in the material. With coarse particles, the decreased solubility may be of considerable significance.

The finer the material is ground, the less important this factor becomes, and with limestone containing 100-mesh material, it is believed that the rate of solubility of dolomitic stones would be sufficiently rapid for all practical purposes. D. v. S.

306. **Relation between Calcium Carbonate, certain Fertilizer Chemicals and the Soil Solution.**

MORSE, F. W. *Soil Science*, Vol. XV, No. 2, p. 75-92. Baltimore, Md., 1923.

In this paper the author states that when solid calcium carbonate exists in the soil in contact with the soil solution, the concentration of calcium carbonate in the solution is dependent upon the amount of carbon dioxide in the soil-air and is independent of the amount of calcium carbonate in reserve. D. v. S.

307. **Availability of Adsorbed Phosphorus.**

WILEY, R. C. and GORDON, N. E. (University of Maryland). *Soil Science*, Vol. XV, No. 5, pp. 371-373, 1 fig. Baltimore, Md., 1923.

The author has shown in this investigation that phosphorus which has been adsorbed by soil colloids and which cannot be leached out by water is available for plant food. D. v. S.

308 **Adsorption and Replacement of Plant Food in Colloidal Oxides of Iron and Aluminum.**

LICHTENWALNER, D. C., FLENNER, A. L. and GORDON, H. N. P. *Soil Science*, Vol. XV, N. 3, p. 157-165, figs. 2. Baltimore, Md., 1923.

The authors prepared colloidal oxides of iron and aluminum in order to find their maximum adsorption from some of the solutions that are commonly used in plant nutrition work. They then tried to find the necessary conditions for the replacement of this plant food. The results are summarised as follows

1. Nitrates suffered only slight adsorption while the sulphates, and particularly the phosphates, suffered large adsorption.

2. The order of adsorption of the cations is calcium, magnesium potassium, while the order in the case of the anions is phosphate, sulphate and nitrate.

3. The time required for equilibrium to be established was a function of the amount of shaking and the rate of adsorption.

4. The adsorption was specific.

5. With solutions of the same salt, the amount of adsorption increased with an increase of concentration.

6. The adsorption of a metallic ion depended upon its accompanying negative ion. The converse is true but to a much less degree.

7. The nitrates and sulphates absorbed by the hydrogels can be entirely leached out by water while only about one-third of the adsorbed phosphates can be removed by leaching with water.

8. Only the water-leachable material followed the adsorption equilibrium law. D. v. S.

309. **Effect of Absorption and other Factors on certain Plant Food and an Improvement for their Estimation. Constituents obtained in the dilute Nitric Acid Digestion of Soils.**

SHEDD, O. M. (Kentucky Agricultural Experiment Station), *Soil Science*, Vol. XV, No. 5, p. 383-393. Baltimore, Md., 1923.

The author's experiments indicate that absorption in some soils is a factor which may appreciably affect results obtained for certain plant-food constituents in the 0.2 N nitric acid digestion as ordinarily employed. The author therefore prefers a short digestion. D. v. S.

310. **The Effect of Gypsum on Iowa Soils.**

ERDMAN, L. W. *Soil Science*, Vol. XV, No. 2, pp. 137-155. Baltimore, Md., 1923.

The author describes the effect of gypsum on different types of soils. In some types the gypsum affected the soil phosphorus and the soil potassium, rendering both more soluble in a water-extract. All the gypsum

treatments were unfavorable to nitrification. A gypsum treatment is important as a supply of sulphur, because the amount of sulphur lost in the drainage is far greater than that added to the soil in the rain water.

D. v. S.

311. **A Note on Soil Reaction Studies.**

KARRAKER, P. E. (Kentucky Agricultural Experiment Station). *Soil Science*, Vol. XV, No. 6, pp. 473-478. Baltimore, Md., 1923.

The author of this paper made lime requirement determinations and hydrogen-ion concentration tests in connection with the yield of red clover in the field. The results have not been presented as a basis for any conclusions, but the author notes the close correlation between limestone treatment or presence of limestone material in soil and hydrogen-ion concentration.

D. v. S.

312.. **Studies on the Hydrogen-Ion Concentration of the Soil and its Significance as regards Vegetation, especially to Natural Distribution of Plants.**

OLSEN C. *Comptes rendus des travaux du Laboratoire Carlsberge.* Vol. 15, N. 1, p. 1-166, fig. 27, bibliography. Copenhagen, 1923.

The object of the present research, which was begun during the autumn of 1916, was to examine the relation of the higher plants to the hydrogen-ion concentration in their natural substratum, namely, the soil. Especially it has been the object to examine whether the hydrogen ion concentration in the soil plays a dominant part as a plant distributing factor in nature, and the investigations, therefore, are essentially of an ecological nature.

The researches include meadow and forest formation (1) as also some formations on open mineral soil. For the botanical analysis of the formations, the formation-statistical method has been used. When using this method a number of trial areas, each of 0.1 m^2 are selected of the formation which is to be examined.

By stating for each species the percentage in which it is found in the selected trial areas, figures are obtained, which express the frequency of the species in the formation. (See further *Raunkjaer* 1909, 1916, 1918). For the determination of the hydrogen ion concentration of the soil samples the author has partly used the electrometric method, partly the colorimetric (both methods elaborated and described, by S. P. L. *Sørensen* 1909). When the colorimetric measurements are executed with careful observation of the rules laid down by the author and with special indicators, sufficiently exact results, i. e. results conformable to the electrometric mea-

(1) The word "formation" is used to designate the smallest phyto-geographical unity; all plant communities the specific composition and appearance of which are essentially alike and the dominating species of which are the same, belong to the same formation.

surements are obtained. The author never recorded a greater difference than 0.2 between the results of the two methods as regards the meadow soil and forest soil, mentioned in this treatise. As regards arable land greater deviations were found ; the difference might here sometimes amount to 0.5 in the pH value.

It seems that the concentration of hydrogen-ions in the soil extracts decreases, when the carbonic acid is driven off by conducting air not containing carbonic acid through the soil (for pH values of the extracts greater than 4).

The concentration of hydrogen-ions of the extract was almost the same, whether they were the result of extracting 70 cc. of soil with 70 cc. of water or with the double volume.

The difference between the pH value of the soil liquid, pressed out of samples of forest soils, and that of the extract is not very great ; it is greatest for the soils the pH value of which lies between 4.3 and 6.3, and smallest for the very acid ones. When the hydrogen-ion concentration of the soil extract does not deviate more from that of the soil liquid than about 0.4, this is of course due to the fact that the soil contains buffer (1).

The hydrogen-ion concentration is of course not the same in all habitats where the composition and physiognomy of the vegetation are identical ; within the same homogenous habitat the deviations can go up to 0.5 in pH value ; furthermore, two soil samples taken from the same spot can deviate up to 0.2-0.3 pH ; no essential differences appeared whether the soil samples were taken at a depth of 5.10 or 20 cm. It was not possible either to observe any fixed influence of the season. The concentration of hydrogen-ions in the very acid soils, and in the raw humus soils, is most constant.

The author also examined the transformation processes of nitrogen in the soil. The samples were divided into two equal parts ; in one half the volume of nitrate and ammonia was determined at once, the other half was put into a jar and stood for a month covered with a glass sheet, and was then analysed. The amount of nitrate and ammonia were expressed in mg. per kilo of dry soil.

For the determination of the nitrate, the phenol disulphonic acid method was used ; this is a colorimetric method giving correct results within a limit of ± 4 %.

As the ammonia is highly absorbed by the soil and consequently only a part is found in an aqueous extract of a soil sample, the extraction was made with 0.5 N sodium chloride solution in which extract the total amount of ammonia will be found (VALMARI 1912). The ammonia was distilled and determined according to NESSLER (see RICHMOND 1915).

In order to determine the contents of the soil of easily soluble mineral plant nutrients in some of the extracts, the quantity of potassium, phosphate and calcium was determined (methods of MITSCHERLICH 1907, 1917).

The author then gives in 16 tables the analysis of meadow habitats

(1) A solution possessing a certain buffer if an admixture of small quantities of acid or base does not essentially alter its hydrogen-ion concentration.

and their vegetation for different pH classes and in 11 tables the analysis of forest soil habitats. Also in 2 tables the transformation processes of the nitrogen in meadow and forest soils for different values of pH.

When a forest is cut an alteration of the vegetation takes place and at the same time an alteration of the hydrogen-ion concentratoin.

Investigations have shown that the hydrogen ion concentration in natural Danish soils lies between the limits 3.4 and 8.0 expressed in pH and that the composition of the vegetation depends on the hydrogen-ion concentration of the soil, as the single species are only found on soil, the hydrogen-ion concentration of which lies within a certain range of hydrogen-ion concentration characteristic for each single species. Within this range is another narrower range in which the species has its greatest average frequency.

When the formations are not too poor in species, it is possible to conclude from the composition of the vegetation, the hydrogen ion concentration of the soil. It appears that both the number of the species as well as their average density, are greatest on soils with a hydrogen-ion concentration which lies near the neutral point ; by increasing hydrogen-ion concentration of the soil the number of the species and their density, decrease generally.

In the case of a number of water culture experiments it appeared that species which in nature are found only on very acid soil (acid soil plants) reached their fullest development in nutrient solutions, with pH values near 4, while species that in nature are found only on slightly acid, neutral and alkaline soil (alkaline soil plants) reached thair most vigorous growth in nutrient liquids, the pH values of which were between 6 and 7. In the slightly acid nutrient solutions, in which alkaline soil plants reached their fullest development, the acid soil plants did not thrive well and became chlorotic.

The hydrogen ion concentration of the soil plays an essentiai part as a plant distributing factor. It may be a question of both direct and indirect effect. Direct : 1) the influence of the hydrogen-ion concentration on the contents of mineral plant nutrients of the soil ; 2) its influence on the course of the transformation processes of nitrogen, especially nitrification, as this is said to be more active in neutral and alkaline soils, and weak or absent in the very acid ones ; 3) its influence on the solubility of the aluminium compounds of the soil.

1) The very acid soils are generally considered as those poorest in mineral plant nutrients, while the neutral and alkaline soils are considered to be the richest. It appears from the investigations that this as a general rule is not correct, for although the most acid soils have been shown to be poor in mineral plant nutrients, especially in phosphates, the very alkaline soils, i. e. the soils essentially consisting of calcium carbonate, may be extremely deficient in these nutrients. If it was not the different hydrogen-ion concentration of the soils examined, but their different content of plant nutrients (which was the cause of their different vegetation), the acid soil deficient in nutrients must resemble the alkaline soils under similar conditions, but this is certainly not the case.

2) It seems furthermore from the investigations that there does not exist in general any closer connection between the intensity of nitrification and the hydrogen-ion concentration of the soil, and that considerable quantities of nitrate may be formed in very acid soils. In the acid soils more ammonia nitrogen will as a rule be found than in the neutral and alkaline ones, in which the whole quantity of nitrogen liberated, is quickly transformed into nitrate. Only in the most acid soils, i. e. in the highmoor peat, in the heath soils and in most raw humus soils, nitrification does not take place. The theory advanced by BEAR and other investigators that acid soil plants are those that are able to use ammonia nitrogen while alkaline soil plants require nitrate nitrogen, and therefore cannot thrive in very acid soils, in which the nitrification is poor or wanting, is not correct. as experiments have proved that ammonia nitrogen and nitrate nitrogen are of the same value as sources of nitrogen in both cases.

3) Culture experiment have proved that the plants found on acid and alkaline soil respectively, generally do not react differently to aluminium compounds in solution; aluminium-ions are not toxic to alkaline plants in general.

Therefore it is probable that it is the hydrogen-ion concentration of the soil *as such* which exercises a considerable influence on the composition of the vegetation. D. v. S.

313. Effect of Reaction on Legumes and Cereals.

I. — BRYAN, O. C. Effect of reaction on growth, nodule formation, and calcium content of Alfalfa, Alsike Clover and Red Clover. *Soil Science*, Vol. XV, No. 1, p. 23-37, 3 pl. Baltimore, Md. 1923.

II. — IDEM. Effect of different reactions on the growth and calcium content of Oat and Wheat. *Ibidem*, Vol. XV, No. 5, p. 375-383, 1 pl. Baltimore Md., 1923.

The effects of different reactions on alfalfa, alsike clover and red clover were studied. The results show clearly that the reaction of the media in which the plants were grown has a direct influence on the growth and nodule formation of the plants. The reactions which were injurious were within the range of reactions of actual soil solutions and suspensions. Acidity and alkalinity produce toxic effects directly, and also influence the power of the plant to obtain sufficient calcium for normal growth. In general the cereals are less sensitive to acids than to alkalies, and also less sensitive to acids than most of the legumes. It appears that wheat is more sensitive to acid media than oats. D. v. S.

314. Effect of Acid Soils on Nodule-Forming Bacteria.

BRYAN, O. C. *Soil Science*, Vol. XV, No. 1, p. 37-41. Baltimore, Md., 1923.

The ability of alfalfa, red clover and soybean bacteria to live and produce nodules, 75 days after being placed in acid soils of different degrees

of acidity, was studied. The alfalfa bacteria were killed at about pH 5 ; the red clover bacteria at pH 4.5-4.7 ; and the soybean bacteria at pH 3.5-3.9. D. v. S.

315. **Soil Acidity as measured by Sugar Inversion, the Truog Test and Hydrogen-ion Concentration and its Relation to the Hydrolysis of Ethyl-Acetate.**

PARKER, F. W. and BRYAN, O. C. *Soil Science*, Vol. XV, No. 2, pp. 99-107, 2 diagrammes. Baltimore, Md., 1923.

The authors state that the Truog test and the sugar inversion method correlate very well with each other and that in a general way both correlate fairly well with the hydrogen-ion concentration. They describe the effect of acid silicates on the inversion of cane sugar and on the hydrolysis of ethyl-acetate in soil suspensions. D. v. S.

316. **Micro-Sampling for the Determination of Dissolved Oxygen.**

ALLISON, R. V. and SHIVE, J. W. (New Jersey Agricultural Experiment Stations. *Soil Science*, Vol. XV, No. 6, p. 489-491, 1 fig. Baltimore, Md., 1923.

The problem of aeration of the substratum as affecting the development of plants in artificial cultures has been the subject of investigation. In this paper the author describes a method of sampling the comparatively small quantities of liquids available in these studies. D. v. S.

317. **Variability of Nitrates and total Nitrogen in Soils.**

PRINCE, A. L. (New Jersey Agricultural Experiment Station). *Soil Science* Vol. XV, No. 5, pp. 395-405. Baltimore, Md., 1923.

In this paper the author treats the question as to how many samples of a soil should be taken for chemical work in order to secure results representative of the entire plot.

It appears that for chemical determinations such as total nitrogen, phosphorus and potash on soil composites, where the accuracy of the analytical method is not extremely delicate and the variability of the soil is not pronounced, 9 or 10 samples covering an area of one-twentieth of an acre and made into a composite would be sufficient. D. v. S.

318. **Aeration Method for determining Ammonia in Alkali Soils.**

GIBBS, W. M., NEIDIG, R. E. and BATCHELOR H. W. (Idaho Agricultral Experiment Station). *Soil Science*, Vol. XV, No. 4, p. 261-268, 2 fig. Baltimore, Md. 1923.

At the Station investigations were made on bacterial activities in alkali soils. The authors here describe a method that can be used for the determination of ammonia in ammonification experiments with alkali soils. D. v. S.

319. **The Estimation of Potash in Soils and Fertilisers.**

I. Page, H. J. (Rothamsted Experimental Station). The Perchlorate Method for the Estimation of Potassium in Soils, Fertilisers, etc. *Journal of Agricultural Science*, Vol. XIV, Part 1, pp. 133-138. Cambridge, 1924.

II. Dodd, A. H. (Chemical Laboratory Thorncliffe, Sheffield). The Determination of Potash in Soils. *Ibidem*, pp. 139-150.

I. *The perchlorate method for the estimation of potassium in soils fertilisers, etc.* — The perchlorate method for potassium estimation was worked out by Davis at Rothamsted, and it was claimed that the method was more simple and more uniform and exact in results and less expensive than the platinum chloride method. However, the irregular and discordant results obtained by the author in certain instances led to a series of investigations which disclosed the fact that a sample of supposed pure perchloric acid was almost entirely chloric acid, and another sample contained a moderate percentage. In an analysis in which such an impure reagent is used the final precipitate consists of a mixture of potassium perchlorate, potassium and sodium chlorates and some unchanged chlorides; the whole of this is weighed as $KClO_4$. The retreatment of this faulty precipitate with pure perchloric acid results in a residue of pure $KClO_4$ of the correct weight.

The author as a result of his investigations concluded that: 1) The presence of chloric acid in the perchloric acid used for estimation of potassium by Davis's method, gives rise to erratic and erroneous results. Every sample of perchloric acid should therefore be tested for freedom from chloric acid before being used; 2) Results indicate that when employing Neubauer's method of treatment of the soil extract to a soil deficient in carbonates, it is sufficient to add only 0.1 gm. of $CaCO_3$ to the extract instead of 0.5 gm. as generally used, a considerable economy of perchloric acid being thereby effected.

II. *The determination of potash in soils.* — The author undertook the analyses of soils of diverse kinds, including samples of most formations from the Carboniferous upwards; these were largely obtained from poor, unmanured grassland, of low potash content. It soon became apparent that the well-known perchlorate method for potash determination could not be used for all soils without modification. Despite all precautions it was found that certain soils gave precipitates which were partially amorphous, or gave material which was not potassium perchlorate. Investigation showed that the perchloric acid was impure, chloric acid being present.

The author discusses the results obtained and the irregularities observed, due to various causes and alludes to the care which must be taken, the use of quartz vessels etc., if the sources of error are to be removed.

In consequence of these difficulties the author is strongly of the opinion that the cobaltinitrite method should replace the perchlorate, as the official method for soil analysis.

The cobaltinitrite method is described in detail and is practically that of Mitscherlich, as modified by Christensen and Feilberg (Christensen and Feilberg, *Landw. Stat.*, 97, p. 27).

The two methods are compared as under :

i) The perchlorate method has the following disadvantages :

It is costly ; requires considerable knowledge of the difficulties and of the literature before consistent results can be obtained ; even in the hands of an expert errors may be made as the composition of the soil extract cannot be known ; the process is very long.

ii) The cobaltinitrite method has the following advantages :

It is cheap ; very simple to carry out, the process being volumetric ; small quantities of other substances do not affect it ; the presence of sodium is no disadvantage. Apart from the evaporation the process is very quick.

The process is no longer in the experimental stage and it would be of great advantage to soil chemists if it was officially recognised.

W. S. G.

320. **A Method for the Determination of Carbonic Acid present as Carbonate in Soils.**

SANYAL, P. H. *Bulletin No. 151, Agricultural Research Institute*, pp. 8, figs. 3, Pusa, 1923.

The Bulletin describes in detail a method and apparatus devised by the author for the accurate estimation of CO_2 in soils. The carbonates are decomposed at ordinary temperatures by dilute hydrochloric acid. The residual CO_2 is driven out by a stream of hydrogen, generated by the action of aluminium and hydrochloric acid and a small quantity of copper-sulphate solution. W. S. G.

321. **The Vegetation and Soil of Africa.**

SHANTZ, H. L. and MARBUT, C. F. *Research Series, No.* 13. *American Grographical Society*, pp. 1-262, figs. 50 + 2 maps. New York, 1923.

The vegetation of Africa is treated from the physical and physiological standpoint, as distinct from classification according to floral structure. Twenty-one types are distinguished thus. Some interesting deductions are given as to the possible or previous extent of types of vegetation.

A survey of the existing agricultural conditions is included, and a description of the assessment of types of land in terms of productivity. The maps illustrate the distribution of vegetation, soil, rainfall and classification. M. L. Y.

322. **Sulphur, Calcium, Magnesium and Potassium Content and Reaction of Rainfall at different Points in Tennessee.**

MACINTIRE, V. H. and YOUNG, J. B. *Soil Science*, Vol. XV, No. 3, pp. 205-227. Baltimore, Md., 1923.

The authors made a great number of analysis of the rain water collected at different points in Tennessee. As a practical application of the

findings reported, it is believed that, under the conditions studied, the rainfall carrying sulphurous materials cannot be assumed to be more active than pure water in producing acid soils. D. V. S.

Fertilisers and Manures.

323. The Utilisation of Indigenous Phosphates in India.

HUTCHINSON, C. M. (Imperial Agricultural Botanist). *The Agricultural Journal of India*, Vol. XIX, Part 1, pp. 4-13, tables 2. Calcutta, 1924.

India possesses deposits of natural rock phosphates, such as those of Trichinopoly and Bihar, and also a large supply of bones, neither of which are at present utilised to any extent for manurial purposes. One of the chief reasons for the neglect of these sources of soil fertility is that it is improbable that superphosphate could be produced economically in the country.

Experimental work has been carried out to discover whether the original rock phosphate could not be used if sufficiently finely ground. It is now well known that the value of ground posphate is determined by the fineness of the grinding ; that no good results can be expected in soils deficient in organic matter, nor in very calcareous soils unless the supply of organic matter is maintained at a high level ; it has been found, however that in soils containing a high percentage of humus, finely ground rock phosphate may give as good results as equivalent amounts of superphosphate.

Many experiments have been made to increase the availability of rock phosphates by means of fermenting organic matter, and a great step in advance was made when the oxidation of sulphur and formation of sulphuric acid by certain classes of soil bacteria was shown by LIPMAN to be of practical importance in rendering soluble mineral phosphates. Work at Pusa during the past three years has proved the possibility of making use of this method in India, as the addition of sulphur to a compost containing mineral phosphate resulted in oxidation of the sulphur and the partial solubility of the phosphate, the effect of which was shown on growing crops.

The author's experiments demonstrated also that by the use of cultures of sulphur oxidising bacteria isolated from such composts, as much as 88 % of the mineral phosphate could be rendered available in ten weeks.

MCLEAN found a ratio of 120 parts sulphur to 400 parts phosphate satisfactory in presence of 2000 parts soil, and this ratio has been found suitable at Pusa.

HOPKINS has shown that soluble phosphate can be obtained as a result of the normal process of nitrification in presence of rock phosphate, and the author has proved the possibility of greatly increasing the activity of nitrifying organisms by simple bacteriological methods, which may perhaps be applicable to this problem.

It is probable that by making use of natural fermentative processes

such as those outlined above, the heavy expenses connected with the manufacture of superphosphate might be largely avoided and the phosphatic mineral resources of India made available. W. S. G.

324. **Reversion of Acid Phosphate in Acid Soils.**

HALL, TH. D. and VOGEL, J. C. (Experiment Station Pochefstroom, South Africa). *Soil Science*, Vol. XV, No. 5, pp. 367-369. Baltimore, Md., 1923.

From the data given in this paper it would appear that there is no actual benefit, as far as the availability of the superphosphate is concerned, to be had from mixing limestone with superphosphate or applying them to the soil separately. D. v. S.

325. **Availability of Potassium in Orthoclase for Plant Nutrition.**

HALEY, D. E. (Pennsylvania State College). *Soil Science*, Vol. XV, No. 3, pp. 167-180, bibliography. Baltimore, Md., 1923.

This investigation had for its purpose the testing of the rate of availability of the potassium of orthoclase when supplied in finely divided form to buckwheat grown in quartz sand cultures.

Twenty-five gram portions of the orthoclase, pulverised to pass through a 200-mesh sieve were found to yield, in distilled water, soluble potassium at the rate of 7 mgm. (282.2 parts per million) at the point of equilibrium between solution and solvent. This orthoclase was added in 25-50 and 75 gram portions and intimately mixed with 2750 gm. of quartz sand to which the other necessary plant nutrients had been added in available forms.

The following are some of the conclusions reached:

Fifty-gram portions of orthoclase supplied potassium at a sufficiently rapid rate to satisfy the requirements of 7 per cent. larger yields of dry matter than were produced by the complete nutrient solution.

The total amount of potassium available from the orthoclase was in no case as large as that in the nutrient solution but the physiological balance of the solution in the sand culture was apparently favorable to a more economical use of the element.

Calcium carbonate and sulphate tended to increase the quantity of available potassium. They also aided in the production of a larger amount of dry matter so long as the lack of potassium was a limiting factor in the growth of the plants.

When the lack of available potassium was a limiting factor, sodium chloride tended to increase the weights of dry matter, but on the whole reduced the amount of available potassium. The effect of sodium sulphate was negative both as to weight of dry matter and amount of potassium absorbed.

Dextrose and starch tended to reduce the weight of dry matter and of potassium absorbed. The addition of calcium carbonate to these materials did not materially affect the results with dextrose but resulted both in an increase in yield and of potassium. D. v. S.

Agricultural Botany.

326. **The Flora of the Island of Hainan.**

GROFF, G. W. DING, E. and GROFF, E. H. The Enumeration of the Mc Clure Collection of Hainan Plants. *The Lingnaam Agricultural Review*, vol. 1, No. 2, pp. 27-86. Canton (China), 1923.

Classification of a fine collection of plants, extremely interesting from the botanical standpoint. The work was undertaken by the Herbarium of the Canton Christian College, China, in conjunction with E. D. MERRILL, the Director of the Bureau of Science in the Philippines.

M. L. Y.

327. **Nutritive Value of Mesquite Beans** (1) ***(Prosopis julifera)*, compared with *Ceratonia siliqua* and *Gleditschia triacanthos*.**

WALTON, G. P. (Cattle Food and Grain Investigation Laboratory). A Chemical and Structural Study of Mesquite, Carob and Honey Locust Beans. *U. S Department of Agriculture Dept. Bulletin* No. 1194, pp. 1-19, tables XI, figs. 2, bibliography, Washington, D. C. 1923.

As the result of the unnecessary waste hitherto incurred in the United States with mesquite beans (*Prosopis julifera*), an investigation has recently been made in the Bureau of Chemistry to study the nutritive value of these beans and their economic utilisation.

The author refers to the distribution of this plant in the South Western areas, and the average yield (up to 100 bus. per acre per annum), and describes in detail the feeding trials made with pigs; the analyses made with dried and whole fruits; fruits separated by hand or milling; pericarp and seed, bean meal, and undissolved residues.

It appears from the results obtained that meal made from the entire bean may serve as a useful supplementary food for stock. If soaked, however, it may have a deleterious effect. If the beans are separated into sugary pericarp and protein bearing seeds by keeping dry throughout the process, a higher value is obtainable. Sucrose was prepared from the pods which contain a higher proportion of non-reducing sugar; the seed kernels were rich in protein, and the seed coats in carbohydrate.

The carob (*Ceratonia siliqua*), also useful in stock foods, contains a lower percentge of protein but is richer in sugar content; the honey locust (*Gleditschia triacanthos*) has a somewhat higher percentage of protein but lower sugar content.

M. L. Y.

(1) See *R.* 1924, No. 23. (*Ed.*)

328. **The Vitamine B Content of *Carica papaya*, *Musa sapientum* and *Vigna sinensis*.**

ACUNA, E. M. The vitamine B. content of some Philippine Fruits and Vegetables. *The Philippine Agriculturist*, Vol. XII, No. 7, pp. 293-302, tables II + chart, bibliography. Los Baños, Laguna, 1923.

Systematic nutrition investigations have been undertaken by the College of Agriculture, Los Baños (Philippines), and the present work deals with the comparative vitamine B. content of banana (*Musa sapientum*), " Papaya (*Carica papaya*) and " paayap " (*Vigna sinensis*).

According to the results obtained with rats, the following conclusions have been reached :— all three fruits contain an appreciable amount of vitamine B., but *Vigna sinensis* has the highest proportion, 5 gm. being sufficient for normal growth when used as a supplement to a standard ration, compared with 10 gm. banana and 20 gm. *Carica papaya*. The tables show the body weight and weekly intake of basal diet respectively, and the chart the comparative growths with the different materials.

M. L. Y.

329. **The Influence of Solution Volume upon Plant Growth in Relation to Reaction Change and Iron Availability in Culture Solutions.**

BARNETTE, R. M. and SHIVE, J. W. (New Jersey Agricultural Experiment Station). *Soil Science*, Vol. XV, No. 5, pp. 413-425, 3 figs. bibl. Baltimore, Md., 1923.

The experiments described in this paper were carried out for the purpose of studying the effect of different solution volumes upon the growth of young wheat plants. A study was also made of the hydrogen-ion concentration changes produced by the action of the plants in different solution volumes and of the influence of these changes upon the availability of iron supplid to the plants in a soluble and an insoluble form.

The types of culture media consisted of the Tottingham solution $T_1 R_1 C_2$ (*Physiol. Reseach* : v. I, p. 327-397, 1914) at an osmotic concentration value of one atmosphere and a modification of this solution used by JONES and SHIVE (*Journal of Agricultural Research*, v. 21, p. 701-728,1921) and consisting in the substitution of ammonium sulphate for the potassium nitrate in equivalent osmotic concentrations.

Some of the main results of the experiments may be summarised as follows :

Hydrogen-ion concentrations are rapidly decreased by the action of the plants in the Tottingham solution in all stages of development. In the modified solution the plants increase the hydrogen-ion concentration of the solution slightly during the early stages of growth and then decrease during the later stages. This reversal in the direction of reaction suggests an important physiological change in the plants with respect to the nitrate and ammonium requirements involving a change in the absorption rates of the NO_3-ions and the NH_4-ions.

Other things being equal, the rates of reaction change are determined by the volume of the culture solution.

The availability of iron (ferrous sulphate and ferric phosphate) is determined mainly by the reaction of the culture solution as this is influenced by the action of the plants.

A direct correlation is found between the decrease in hydrogen-ion concentration of the culture solutions and the appearance of chlorosis in the plants.

D. v. S.

330. **Further Notes on the growing of Wheat in One-Salt Solution.**

GERICKE, W. F. *Soil Science*, Vol. XV, No. 2, pp. 69-75. Baltimore, Md., 1923.

In this paper the author states that the absorption and utilization of nitrates by the wheat plant is largerly dependent upon the relative supply of available potassium in the medium. If either is to be utilized, both must be present and absorbed at the time.

D. v. S.

331. **A Comparison of the Absorption of Inorganic Elements, and of the Buffer Systems of Legumes and Non-Legumes, and its Bearing upon existing Theories.**

NEWTON, J. D. *Soil Science*, Vol. XV, No 3, pp. 181-204, 12 figs., bibliography. Baltimore, Md., 1923.

Experiments are described with barley and peas or beans in order to compare their absorption of calcium, potassium, magnesium, nitrogen and phosphorus. The author gives 12 diagrams representing the acidity of the plant saps.

The more important results may be summarized as follows :

There are no characteristic differences in the types of absorption from nutrient solutions by barley and peas, or by barley and vetch. Such differences exist, on the contrary, between barley and beans, in the early stage at least. Beans absorb more calcium in proportion to potassium, than either barley or peas.

The quantity of calcium absorbed by a plant does not necessarily depend upon the quantity of nitrogen absorbed or metabolised, as has been suggested by other workers. It was found possible to decrease the quantity of calcium absorbed by barley and peas without decreasing the quantity of nitrogen absorbed, by growing the plant in solution low in calcium Moreover, its was found that inoculated peas absorbed more nitrogen than uninoculated, when grown in the cultures low in nitrogen, but did not absorb more calcium, although there was plenty of this element available.

The quantity of carbon dioxide given off from the roots of pea plants grown in sand cultures was found to be very much greater than

that given off from the roots of barley plants of a similar size. This offers a very probable explanation for the fact that pea plants absorb more calcium and magnesium from a soil than barley plants, although they do not absorb more calcium or magnesium from a nutrient solution. In the soil, carbon dioxide would affect the solubility of calcium and magnesium compounds.

The hydrogen-ion concentration of barley, peas and beans was not appreciably increased by limiting the plant's supply of calcium. In these cases there was actually less calcium present in the sap, and a less percentage in the plant as a whole. The buffer effect of barley and pea sap was similar, but was greater in the case of beans.

D. v. S.

332. **The Relation of Seed Weight to the Growth of Buckwheat in Culture Solution.**

SCHMIDT, D. (New Jersey Agricultural Experiment Station). *Soil Science*, Vol. XV, No. 4, p. 285-292, 2 figs. Baltimore, Md., 1923.

At this Station a series of experiments dealing with the relation of seed weight to germination, subsequent growth of the plants, and crop production was begun. This paper is a preliminary note on buckweat. The author notes that seeds of high medium weight produced better plants, than seeds of lighter weight or abnormally heavy seeds. Leaf areas were approximately proportional to dry weights of tops and to total dry weights, but no such relation was apparent between dry weights of roots and leaf areas.

D. v. S.

333. **Physiological Studies on Apples in Storage** (1).

MAGNESS, J. R. and DIEHL, H. C. (Office of Horticultural Investigations, U. S. Bureau of Plant Industry). *Journal of Agricultural Research*, Vol. XXVII, No. 1, pp. 1-38, tables XI, bibliography. Washington, D. C., 1924.

Observations on the physiological changes in the apples during the process of ripening on the tree : — increase in size, changes in colour, texture, and acid content, etc. — factors all closely associated with storage quality. The authors review the subsequent changes which occur after picking, and study the effect of storage conditions, packing, ventilation, and temperature relative to acidity, loss of moisture and weight. Coating the fruit with paraffin or oil results in a slower rate of softening and respiration tests were made at different temeperatures. Concentration of carbon dioxide up to the rate of 2-3 % has no deleterious effect on the fruit, and will retard softening. A high concentration will, however, hinder ripening.

M. L. Y.

(1) See *R.* 1924, No. 25, (*Ed.*)

334 **Nodule-Production Kinship between the Soybean and the Cowpea.**

LEONARD, L. T. (Bureau of Plant Industry) *Soil Science*, Vol. XV, No. 4, pp. 277-283. Baltimore, Md., 1923.

An interchangeability of the nodule-forming function between cultures of *B. radicicola* from soy bean (*Soja max*) and cow-pea (*Vigna sinensis*) is indicated by work carried out under pure culture conditions.

D. V. S.

335. **The Destruction of Pentosans by Moulds and Other Micro-organisms.**

SCHMIDT, E. G., PETERSON, W. H., and FRED, E. B. *Soil Science*, Vol. XV, No. 6, pp. 479-488, bibl. Baltimore, Md., 1923.

In studying the activities of moulds and other micro-organisms it was found that moulds could destroy pentosans (five-carbon-atom sugars distributed in nature as polysaccharides) of maize forage, rye straw, wood. These organisms would not grow on a synthetic liquid medium with wood as a source of carbon. When placed in wood-soil, in 6 months about 60 % of the total pentosan content of the wood was destroyed. Pentosans are more readily attacked than the cellulose, lignin and other constituents of the wood.

D. V. S.

Plant Breeding.

336. **The Inheritance of Growth Habit and Resistance to Rust in the Wheat Cross Kanred × Marquis.**

AAMODT, O. G. *Journal of Agricultural Research*, Vol. XXIV, No. 6, pp. 457-468, tables 2. Washington, 1923.

One of the chief causes of injury to hard, red, spring wheat is *Puccinia graminis tritica* Eriks. and Henn., a fungus which occasions heavy loss in the spring wheat regions of the United States, therefore the problem of finding a type of early wheat immune to the attack of this rust was a matter of great importance, but of considerable difficulty, owing to the numerous biological forms of the parasite each of which necessitated a special condition of immunity.

The present paper gives the results of a series of researches conducted with the object of obtaining the desired type by crossing Marquis, a susceptible spring wheat, with the autumnal wheat Kanred which had proved resistant to 2 of the 21 biological forms of *Puccinia graminis* known in the Lower Valley of the Mississippi and immune to 12 of these forms. Being an autumn wheat, Kanred does not head at all, or bears a few seedless ears, when sown in the spring.

In the F_2 of Marquis × Kanred, 5250 individuals were obtained which may be divided into 9 classes as regards the time and manner of heading; 1980 individuals headed regularly and at the same time as the Marquis parent, thus behaving like true spring wheat. The second class was composed of 1503 individuals which headed one week later,

as did the hybrids of all the remaining classes, except the eighth, which consisted of 19 plants that headed with difficulty, producing ears seven weeks late. The ninth and last class included 442 individuals that never headed and therefore behaved like the Kanred parent.

All the plants of the first five classes ripened like ordinary spring wheat. Taken all together, they included 4350 individuals of the spring type as against 900 of the autumnal type, the ratio being as 5 : 1 with partial dominance of the spring wheat.

The following tables give data referring to the F_3.

TABLE I. — *Height attained by F_3 Plants derived from different F_2 Lots of the Hybrid Kanred × Marquis.*

Class of heading	Number of familes			
	Total	Homozygous for spring form	Heterozygous for habit of growth	Homozygous for autumn form
1	10	10	0	0
2	10	6	4	0
3	10	7	3	0
4	10	5	5	0
5	10	2	8	0
6	6	0	9	0
7	6	0	4	2

TABLE II. — *Reaction shown by the Wheats, Marquis, Kanred and of various Families of the F_3 of a Cross between Kanred and Marquis to Biological Type I of Puccinia graminis tritici.*

Class of heading	Homozygous resistance		Heterozygous resistance			Homozygous for susceptibility	
	No. of families	No. of individuals	No. of families	No. of resistant individuals	No. of susceptible individuals	No. of families	No. of individuals
1	3	102	4	96	26	3	82
2	3	75	7	184	54	0	0
3	3	108	4	102	35	3	88
4	1	21	8	239	59	1	26
5	4	111	4	89	28	2	73
6	6	140	3	65	18	1	24
7	3	50	2	23	2	0	0
Totals. .	23	607	32	798	222	10	293
Marquis .	—	0	—	0	0	—	83
Kanred .	—	83	—	0	0	0	0

The families in the F_3 that were descended from the F_2 hybrids of the first class were all homozygous as regards the spring-wheat habit, while those descended from the second class were divided into two groups, one of six homozygous individuals and the other of four heterozygous, there being a progressive decrease in the number of homozygous spring families. The progeny of the sixth class were all heterozygous, whereas the seventh class was composed of four heterogygous and two homozygous families as regards the autumn growth habit. Therefore, from the growth standpoint, the offspring of the spring × autumn behaved according to Mendel's laws, while the complexity of the results revealed the existence of multiple factors involved in the expression of the growth character. The F_3 families descended from the first seven classes of heading were subjected to artificial infection tests in which spores of *Puccinia graminis tritici*, biological form I, were used. The results obtained are summarised in table II.

TABLE III. — *Reaction shown to* 13 *biological forms of Puccinia graminis tritici by the Wheats Marquis, Kanred, and Families of the F_3 of the Cross Kanred × Marquis.*

(S = susceptible; I = immune; R = resistant).

Biological form	Varieties, or hybrid family number.																
	Marquis	Kanred	29	30	32	41	42	43	47	48	51	55	60	79	80	181	183
I	S	I	—	—	I	I	—	—	—	I	I	I	I	I	I	I	S
III	S	S	—	—	—	S	S	S	S	S	—	—	S	S	S	S	S
IX	S	I	I	I	—	I	—	—	—	—	—	I	—	—	I	I	S
XIV	R	I	I	—	—	I	I	I	I	I	—	—	—	—	I	—	—
XVII	S	I	I	—	I	I	—	I	—	—	—	—	I	—	—	I	S
XVIII	S	S	S	—	S	S	—	—	S	—	—	—	S	S	S	S	S
XIX	R	I	—	—	I	I	—	—	—	I	—	—	I	I	I	I	—
XXI	S	I	—	—	I	I	I	—	I	I	—	—	I	I	I	I	S
XXIX	S	I	I	I	I	I	—	I	—	I	I	I	I	I	I	—	—
XXXII	S	S	—	—	—	S	—	—	S	S	S	S	S	—	—	—	—
XXXIV	S	S	—	S	—	S	—	—	S	—	S	S	S	S	S	—	—
XXXVI	S	S	—	S	S	S	S	—	S	—	—	—	—	—	—	—	—
XXXVII	S	I	I	—	I	I	—	—	I	I	I	I	I	—	I	—	—

The 13 biological forms given in table III may be divided into two groups. The first group is typically represented by form I (to which Marquis is susceptible, while Kanred is immune), and the second represented by form III to which both wheats are susceptible.

The data given in table II show that the separation of the characters of resistance and susceptibility to this form of *Puccinia* is very simple, the usual ratio being 3 resistant to 1 susceptible. In the F_3 there were

some types homozygous as regards habit of spring-growth and immune to form I.

The results obtained respecting the other biological forms of *Puccinia graminis* are summarised in table III.

Therefore the families of the hybrids may be divided into two groups according to their behavoir as regards the Kanred and Marquis parent respectively. Thus, for instance, family 41 behaved exactly like Kanred in its reaction to all the forms of *Puccinia* used in the artificial infection experiments, while family 181 behaved in all respects like Marquis.

The results obtained prove that the resistance, or susceptibility, shown to certain biological forms of *Puccinia graminis tritici*, can be determined either by a single genetic factor, or by a group of linked factors. Thus in order to estimate the resistance of Kanred and of its progeny it is only necessary to employ one form, since the reaction produced will be the same as in the case of all the other forms to which Kanred is immune. By this means, numerous F_3 selections were made and some pure spring wheats obtained which were immune from all the forms of *Puccinia* to which their parent Kanred had proved immune.

G. A.

337. **The Relation between Chromosome Number, Morphological Characters and Rust Resistance in Segregates of Partially Sterile Wheat Hybrids.**

Sax, K. *Genetics*, Vol. 8, No. 4, pp. 301-321, fig. 1. Menasha (Wisc.), 1923.

The relation between the number of chromosomes, the morphological characters of the plants, and rust resistance was studied in individuals of the F_3 of *Triticum vulgare* (Amby) × *T. durum* (Kubanka).

Triticum vulgare, as is well-known, belongs to the group of Triticum with 21 chromosomes, while *T. durum* is a member of the group with 14 chromosomes (haploid).

It was found from the cytological examination of 46 hybrids of the third generation, that some of the individuals possessed 14 chromosomes and others 21. The closest correlation was found to exist between chromosome number, morphological characters and rust resistance.

The plants with 14 chromosomes possessed the rust resistance and anatomical characters proper to *durum*, whereas those with 21 chromosomes had the susceptibility and structure of the *vulgare* parent.

Special mention should be made of the relation between resistance to rust and awn length. The completely awnless hybrids were exceedingly susceptible to the parasite, while the awned hybrids proved resistant, the resistance increasing with the length of the awn. The size of the pollen grains increased with the number of chromosomes.

G. A.

338. **Correlation between Increase in Weight of Hybrid Maize Seeds and the Productivity of Their First Generation.**

CARLES DES CARBONNIÈRES, F. La première génération hybride du maïs. *Bulletin mensuel du Comice agricole de Castre*, No. 2, pp. 12-15; No. 3, pp. 21-23; No. 4, pp. 27-31. Castres (Tarn), 1924.

The author advocates the use of first generation hybrids as a means of increasing maize yield, and gives a detailed description of the technique employed for the production of these hybrids.

1) Into a field sown with the local variety that succeeds best are introduced some rows of a different variety or several other varieties, so that the plants, which have been detasselled before pollination, may be fertilised by the variety surrounding them.

Several rows of the local variety are also detasselled and, in this way, are obtained crossed seeds, in some cases inferior to the hybrid seeds, but very superior to ordinary seeds. These will have been still further improved if the rows of the female parent plants have been sown with the same variety, which has been grown for a long time in another and far distant place.

The varieties to be crossed must be pure, flower at the same time, produce a heavy yield and seed of the same colour.

The crossing operation should be repeated annually in order to obtain seed for the following season.

2) a simpler method is : to sow 2 or 3 varieties in alternate rows.

3) Allow the self-fertilisation of different varieties A, B, C, D, in order to obtain them in a pure condition ; cross the pure lines $A \times B$ and $C \times D$; recross the hybrids $(A \times B) \times (C \times D)$. In this manner, a large amount of seed is obtained and the first generation of the combined hybrid is stronger and more productive than that of it parents.

The seed resulting from fertilisation with the pollen of another variety is heavier than that produced when pollen of the same variety is employed, therefore a certain correlation must exist between the weight of the seeds in the F_1 and the increased vigour of the F_1 plants. The embryo and the endosperm are hybrids of the same order with the sole difference that the development of the endosperm begins the first year and that of the embryo the succeeding year within the plant which is its continuation. The degree of the plants heterosis should thus be seen in the seed beforehand.

The more the heterozygous seeds are superior to the pure seeds both in weight and volume, the greater the fertility and vigour of their immediate progeny. Thus we have a mathematical basis upon which to calculate in advance the index of yield of the first hybrid generations of maize, and an easy and rapid means of classifying a large collection of hybrids according to their order of merit. It will, however, be necessary to make further investigations in order to determine whether the agreement is sufficiently exact and general to constitute a rule.

F. D.

339. **Segregation and Correlation of Characters in an Upland Egyptian Cotton Hybrid.**

KEARNEY, T. H. (Bureau of Plant Industry). *Bulletin* No. 1164, pp. 57, plates 21, bibliography. *United States Department of Agriculture, Washington, D. C.*, 1923.

This Bulletin gives a detailed account of the results obtained from crosses made between plants of the Holden variety of Upland cotton and the Pima variety of American Egyptian cotton. The author's object in these experiments was to obtain statistical data as to the nature of the variants to be expected in fields of either type when exposed to natural cross pollination by the other. The resulting hybrids were studied in the first, second and third generations.

Of the 38 characters whose intercorrelations were determined in F_2, 37 are connected by coefficients of correlation amounting to at least 3 ½ times the probable error.

It may be inferred from the results of this work that, although the data on correlation indicate relative freedom of recombination, the chances are heavily against the isolation and fixation of a productive type of cotton, combining the most desirable characters of both parents, from the segregation products of so wide a cross as that between Upland and Egyptian varieties of cotton. W. S. G.

340. **The Factor for Bitterness in the Sweet Almond.**

HEPPHER MYER, J. *Genetics*, Vol. 8, No. 4, pp. 390-391. Menasha (Wisc.), 1923.

At the Agricultural Experiment Station for California, many crosses have been made between some valuable varieties of almond with the object of obtaining types that flower a little later than usual and are therefore less exposed to injury from frost.

Among the hybrids resulting from these crosses, individuals bearing bitter almonds occurred in the ratio of 1 : 3 ; thus, out of a total of 243 trees, 184 produced " sweet " and 59 " bitter " almonds.

The presence of the bitter almonds is explained by the author as due to the fact that the cultivated varieties are hybrids having the structure *Bb*, so that the factor upon which bitterness depends is recessive to the factor producing sweetness. G. A.

Seeds.

341. **Electrochemical Treatment of Seed Wheat.**

LEIGHTY, C. E. and TAYLOR, J. W. Circular 305, pp. 7, bibliography, United States Department of Agriculture, Washington D. C., 1924.

Methods for increasing crop yields by the use of electricity have received attention for many years, one of the most important being that known

as the « Wolfryn Process » (1) in which the seeds of crops are subjected to an electric current passing through a conducting solution in which the seed is immersed.

It has been claimed that largely increased yields have been obtained by such treatement, in which the conducting medium was a solution of common salt, and the object of the authors' experiments was to investigate this claim.

MERCIER and FRY reported increased gains of 20 to 30 % in cereals, and reduction in losses from bunt, rust and wireworm.

No really critical results are given as the basis for these claims.

RUSSELL reports the results of pot experiments with electrically treated seed at Rothamsted in 1918 and 1919, in which no advantage was shown for seed so treated. In pot experiments with wheat at Oxford an increase of 12 % more grain and slightly less straw was obtained than with untreated seed. In a field experiment carried out by ROBB at Wye Agricultural College (Kent) with barley and oats one variety of oats showed a slight increase but another variety and barley showed a decrease. Two other trials at Cambridge showed no increase.

BIFFEN states that : " The trials show no improvement in yields as the result of treatment ; there was a small diminution of germinating capacity ". LEE in Manitoba, with Marquis wheat on a single-plot test obtained an increase of 3 ½ bushels of grain over the control (14.5 : 18.0).

The authors began their experiments in 1920 at the Arlington Experiment Farm in Virginia, using a soft variety of red winter wheat. The grain was presoaked for two hours in a 3.5 % solution of common salt, and a current of about 200 watts was passed through the solution for 3 ½ hours. As controls, a second lot of seed was soaked in a duplicate salted solution for 5 ½ hours, but without electricity, and third lot was soaked in water for an equal time. The seed was allowed to dry and was sown two days later. These experiments were repeated in 1921. After a three days germination test the counts were as follows :—

Water-soaked 88 %, electrically treated 84 %, salt-solution 74 %.

Leaf rust (*Puccinia triticina*) was severe in 1921 and 1922, all plots being equally affected.

In 7 out of 8 cases the control plot gave a higher yield than the plot next to it sown with electro-chemically treated seed.

The conclusion drawn from the experiment is that no benefit or profit was shown from treating wheat seed electro-chemically by the so-called " Wolfryn " process. W. S. G.

(1) See *R.* 1923, No. 734. (*Ed.*)

342. **Means of recognising killed Glomerules in Beet Seed.**

HIRSCHWITZ, S. (Agrikulturchem. und bakteriolog. Institut der Universität zu Breslau). Der Nachweis abgetöter Knäule in Rübensamen. *Zeitschrift des Vereins der Deutschen Zuckerindustrie*, No. 811, pp. 115-134, bibliography. Berlin, 1924.

The German law regulating the beet seed trade requires that, at least, 80 % of the large glomerules, 75 % of the medium, and 70 % of the small glomerules of the sugar-beet seed put on the market shall germinate in 14 days, the minimum percentages in the case of forage beets being 75 for the large glomerules, and 70 for the small. There is thus a risk of the seller mixing seed of a higher germinating capacity than is legally required with old seed, or seed with little germinating power. If this fraud is perpetrated by mixing spoilt seed with good seed of the same variety it easily escapes detection, but should the seed belong to different varieties, the seller kills the seed before mixing it, for otherwise, as soon as germination took place, the fraud would at once be detected and the buyer would have the right to demand the reimboursement of the price of the seed and also the payment of damages. As a rule the seeds are killed by dry heat which destroys the germinating capacity without altering the morphological structure. The author attempted to discover some way of recognising the glomerules that had been destroyed ; he established the following facts amongst others:

The temperature limit of the germination of glomerules: they are killed at 125°C.

The changes taking place in the digestible albumin of heated seeds. The percentage decreases at temperatures of 175°C. and over, falling to 70-75 % of the initial percentage.

Determination of germination capacity by LESAGE *method* (1). This proved unsuited for the purpose because beet-seeds of full germinating power easily part with their colouring matter even when placed in pure water.

Volumetric determination of oxygen liberated from oxygenated water by the action of the catalases in the seeds heated to different temperatures.

1) The volume of oxygen freed by ground beet seeds is in inverse proportion to the temperature to which the seeds have been heated ; 2) the activity of the catalases is only perceptibly changed at temperatures above 100°C. Distinctly differences show themselves at fairly different temperatures (70-100-125°C), but the variations occurring at the same temperature (up to 20 %) are so great as to render the method inapplicable.

New method for recognising glomerules that have been killed. — This is based on the fact that the catalases situated at the periphery of the glomerule are most affected by heat. At a temperature of 125°C. (which kills the seeds), the catalase loses some but not all of its activity, for the ferment present in the centre of the glomerule is more or less unaltered. If entire, unheated glomerules are put into oxygenated water, an energe-

(1) Described in *Comptes rendus de l'Académie des Sciences*, Vol. 174, p. 766, Paris, 1922. This method is based in the fact that seed which have lost their capacity of germination impart a yellow colour to dilute solutions of potassium hydrate: while seeds that are still able to grow, retain their colouring matter unless they are put into much stronger solutions.

tic liberation of oxygen takes place after 2-3 minutes ; the same thing occurs in the case of glomerules heated to 70°C. ; if, however, the temperature has been raised to 100°C., much less oxygen is liberated and none is given off before 15-20 minutes, while if the glomerules have been heated to 125°C. no decomposition takes place until an hour has elapsed. The retarding of the reaction is due to the time needed for the oxygen to pass through the layers in which the catalases have been destroyed.

The operation is carried out as follows : some melted paraffin that has been coloured brown is poured into a plate, and before the wax has entirely solidified small holes are made in it with a glass rod. One glomerule is then put into each hole and a sheet of glass is laid on the paraffin. The oxygenated water is poured on the sheet, and runs under the edges of the glass, thus finding its way into the holes in the paraffin and causing the reaction.

This method proved perfectly satisfactory in 193 cases out of 297 ; in 84 cases, the error was 1 % ; the maximum error (which only occurred once) was 5 %. F. D.

343. **Disadvantage of Treatment of Cotton Seed with Superphosphate Paste to remove Fuzz.**

WATKINS, W. R. *Agricultural Gazette of New South Wales*, vol. XXV, Pt. I, p. 10. Sydney, 1924.

Amongst other methods suggested for the treatment of cotton seed to get rid of the "fuzz" which prevents it running freely through the plate in the drill, is the use of superphosphate paste. Recent tests made in New South Wales on the Grafton Experiment Farm demonstrate the detrimental effect on germination when this paste is employed. The seed coat becomes hardened and in many cases the seedlings fail to appear. If they succeed, the plants have a withered appearence and a yellowish tinge on the leaves. M. L. Y.

CROPS IN TEMPERATE AND TROPICAL COUNTRIES

Cereals

344. **The Influence of Irrigation Water on the Composition of Grains and the Relationship to Nutrition.**

GREAVES J. E. and CARTER, E. G. (Utah Experimental Station) *Journal of Biological Chemistry*, Vol. LVIII, No. 2, pp. 531-541, tables 6, bibliography. Baltimore, M. D., 1923.

Irrigation water applied to soil affects both the quality and the quantity of the grain grown in that area. The authors have carried out a series of experiments at the Utah Experiment Station on the total ash, nitrogen, phosphorus, potassium, calcium and magnesium content of wheat, oats and barley, which were grown on the same soil having a variation in moisture content. The results given are averages of from 6 to 10 analyses made on grain from 3 to 5 plots, receiving like quantities of irrigation,

each of these averages is further made up of a composite of from 3 to 5 annual yields.

The ash content of wheat, oats and barley increases with an increase of irrigation water, the maximum for wheat being reached with somewhat less than 67.5 inches of water. There is a gradual progressive increase in phosphorus as the quantity of irrigation water used in their production increases up to 35 inches yearly. Above this there is a decrease. The increase in the case of wheat amounts to 55 %, oats 35 % and barley 30 %, hence the user of grain grown under these conditions obtains these greater quantities of phosphorus, and the soil is depleted to the same extent.

As regards potassium : wheat grown with 35 inches of water contains 35 % more potassium than when grown without irrigation. Oats when receiving 45 inches of water increase the potassium content 31 % and barley reaches its maximum increase of 14 % with 20 inches of water.

The calcium content increased 155 % for wheat, 22 % for oats and 41 % for barley.

The magnesium content increase was, 32 % for wheat, 65 % for oats and 9 % for barley.

The ratios of calcium and magnesium to phosphorus indicate that the increase in phosphorus is mainly inorganic.

Wheat, oats and barley were all found to decrease in nitrogen as the irrigation water used in their growth increased. The decrease for wheat was 21 %, oats 40 %, and barley 19 %.

The results indicate how over-irrigation may deplete the soil in two ways : it washes out the soluble nitrogen which is a limiting factor in soil fertility in the arid region and thus produces a low protein grain, and also, it causes the grains to take up larger quantities of potassium and phosphorus, thus depleting the soil, with the result that the farmer receives less per unit for each of these essential elements which are sold from his farm.

W. S. G.

345. Recent Strampelli Wheat Varieties.

STRAMPELLI, N. I più recenti grani Strampelli (1). *L'Italia agricola*, Year 60, No. 9, pp. 353-368 + 30 coloured plates. Piacenza, 1923.

A special number devoted entirely to a full description of some 37 new wheat varieties obtained by crossing and selection at the " Istituto Nazionale di genetica per Cerealicoltura ". (Cereal Experiment Station) at Rieti under the direction of the author. The article is well illustrated by coloured plates. As regards classification of these wheats, the principal characteristics are mentioned, crop yield, and resistance to rust and lodging.

SOFT AUTUMN WHEATS, AWNLESS. -- " Dante ", ears white ; caryopses reddish white ; culms 80-85 cm., medium density ; early.

(1) See *R.* 1916, p. 777; *R.* 1919, No. 182; *R.* 1920, Nos. 732, 851, 956, 1079. (*Ed.*).

" Stamura ", ears white ; caryopses, pale reddish white ; culms 90-100 cm ; fairly high tillering strength ; medium early.

" Italo Giglioli ", ears white ; caryopses yellowish red ; culms 95-100 cm. ; medium tillering ; very early.

" Fausto Sestini ", ears pale yellow ; caryopses pale yellowish-white ; culms about 110 cm. ; average tillering ; comparatively early ".

" Attilio Fabrini ", ears white ; caryopses red ; culms 95-100 cm. ; fairly early.

" Cuboni ", ears milky white ; caryopses pale reddish white ; culms 95-100 cm, ; average tillering ; early.

SOFT AUTUMN WHEATS, AWNED. — " Francesco Strampelli " ears deep red ; caryopses reddish white ; culms 80-90 cm. ; medium yield ; fairly early.

" Carlottina Bianca ", ears white, caryopses yellowish-red ; culm 65 cm. ; medium tillering ; yield early.

" Carlottina Rossa ", ears red ; caryopses yellow flesh-coloured.

" Vittorio Veneto ", ears dark red ; caryopses yellow flesh-coloured ; culms about 120 cm. ; high tillering ; normal ripening.

" San Michele " ; ears deep yellow ; caryopses yellow ; culms about 110 cm. ; high tillering ; fairly early.

" Gorizia " ; ears white ; caryopses flesh coloured ; culms about 90-10 cm. ; normal ripening.

" Trieste ", ears white ; caryopses dull flesh coloured ; culms 100-110 cm. ; medium tillering ; normal ripening.

" Trento ", ears white ; caryopses reddish-brown ; culms 90-100 cm. ; average tillering ; somewhat early.

" Fiume ", ears straw-coloured ; caryopses reddish-brown ; culms 110-115 cm. ; tillering somewhat low ; early.

" Zara ", ears white ; caryopses red ; culms 115-130 cm. ; normal tillering, somewhat early.

" Cantore ", ears white ; caryopses light yellow flesh coloured ; culms 115-125 cm. ; fine tillering ; fairly early.

" Enrico Toti ", ears red ; caryopses light red, culms 85-90 cm. ; medium tillering, fairly early.

" Villa Glori " ears dark red ; caryopses reddish white ; culms about 90 cm. ; medium tillering ; fairly early.

" Mentana ", ears red ; caryopses dull yellow flesh coloured ; culms 90-100 cm. ; normal tillering ; fairly early.

" Goito ", ears red ; caryopses red ; culms 90-100 cm. ; high growing ; fairly early.

" Palestro ", ears red ; caryopses light red ; culms about 110 cm. ; slightly early.

" Castelfidardo ", ears deep yellow, caryopses light yellowish-brown ; culms about 100 cm. ; normal tillering ; fairly early.

" Marsala ", ears white ; caryopses reddish ; resistance to drought

" Caprera ", ears light reddish yellow ; caryopses flesh coloured ; resistance to drought.

" Calatafimi ", ears deep yellow ; resistance to drought.

HARD WHEATS. — " Volturno ", ears bluish-black ; caryopses red ; normal tillering and ripening ; high yield, even during drought.

" Milazzo ", ears whitish ; caryopses amber coloured ; normal tillering and ripening ; high yield.

" Senatore Cappelli ", ears yellowish-white ; caryopses ; amber coloured, normal tillering and ripening.

Daini II to VIII ; confined entirely to arid regions of southern Italy.

F. D.

346. " Trigo sertanejo " a Wheat Grown at Montes Claros, Minas Geraes, Brazil.

BARBOSA, J. Trigo sertanejo. *Revista Agricola, Industrial e Commercial Mineira*, Vol. I, part. 7, pp. 443-44. Bello Horizonte, 1923.

In the district of Montes Claros, wheat has been cultivated for over a hundred years with the result that a very fine, strong hardy type has been produced which is not subject to any disease and bears heavy crops. Dr. ALVES COSTA procured some seed of this variety and forwarded it to the Ministry of Agriculture at Rio de Janeiro, whence some of it was sent to the Centenary Exhibition (1922,) where it was greatly appreciated, while the rest was dispatched by the said Ministry to Señor H. KOBBE, Director of the " Campo de sementes " of S. Simão, State of São Paulo, who cultivated it and obtained results exceeding all expectations. The wheat was sown on May 29, 1923 ; it began to come up on June 4, and was harvested on October 25, 150 days after seeding. The yield was 19.3 quintals of grain per hectare, and 44.2 quintals per hectare of straw. The fact that this wheat can be sown in May enables it to be grown after the maize (the cereal at present most cultivated) has been carried.

F. D.

347. Gluten Percentage in some American and Italian Wheats.

ALTOMANI, P. Il contenuto in glutine in grani nazionali ed esteri. *Giornale di Agricoltura della Domenica*, Year XXXIV, No. 5, p. 38. Piacenza, 1924.

With a view to ascertain whether, or not, Italian grown wheat should be mixed with American wheat (in order to increase the gluten content of the former and make it more suited to bread-making), the author carried out a series of analyses in the Laboratory of Agricultural Chemistry of the Royal University of Bologna. The results, which are given, show that as a rule, American wheat does not contain a perceptibly larger percentage of gluten than Italian wheat, and indeed, some varieties of Italian wheat are superior to the American product in gluten percentage.

Italian flour satisfies all the requirements of the baker as regards the quantity, and especially the quality, of the gluten present. The author

has found from working the various doughs, that the Italian grain studied contained gluten of as good quality as any of the American wheats with which it was compared.

Varieties of wheat	Gluten		Protein substances (N × 5.25)
	moist	dry	
Crop 1922:			
Gentilrosso 48	33	11.0	—
Inallettabile 96	37	12.0	13.81
Rieti 11	38	12.6	—
Crop 1923:			
Manitoba No. 1 (American)	38	12.4	1.4
Manitoba No. 2 (American)	35	11.4	—
Azima (Russian)	40	13.0	—
Cologna (grown from seed)	32	10.8	—
Gentilrosso (grown from seed)	25	8.8	—
Gentilrosso fam. 48	32	10.2	12.50
Inallettabile fam. 96	34	11.0	12.98
Rieti fam. 11	38	12.2	13.65

F. D.

348. **Maize: Production and Utilization.**

I. — *The New International Encyclopedia*, Vol. XIV, pp. 697-701. New York, 1923.

II. — *Encyclopedia Britannica*, Eleventh Edition, Vol. 17, pp. 448-449. Cambridge, 1911.

III. — United States Department of Agriculture, Service and Regulatory Announcements, No. II pp. 4, *Official Grain Standards of the United States for Shelled Corn*. Washington, 1916, and No. 12, pp. 40. Notice of hearings on proposed Rules and Regulations of the Secretary of Agriculture. Washington, 1916.

IV. — *Statistical Notes on the Cereals*. No. 7, pp. 108, April 1918 (International Institute of Agriculture, Rome).

V. — *Statistical Year Book for* 1922, pp. 104 to 107 (International Institute of Agriculture, Rome).

VI. *United Empire* (Royal Colonial Institute Journal). Vol. V, new Series, No 4, April 1924. The Resources of Rhodesia, p. 263 (London 1924).

Maize (*Zea Mays*) is of the order of gramineae or grasses; more than 300 varieties are known to be under cultivation in various parts of the world, but in the native, or wild state it has not been traced. The characteristics of the many varieties differ among themselves more widely than is the case with any other cereal. The most probable theory as to origin is that maize is indigenous in tropical America, but was entirely unknown in the Old World or Eastern Hemisphere until the discovery by Columbus. There are, however, authorities who state that some seed was brought into Spain

by the Arabs in the thirteenth Century A. D., and that this variety was perhaps indigenous in Asiatic Countries. It is not mentioned by travellers in those regions, or in Africa, earlier, than the 16th Century, when contemporary Chinese drawings also depict this plant.

On the other hand in Peru small grains of maize of an unknown variety have been found in ancient tombs, and DARWIN discovered maize cobs embedded in the detritus of a former shore, now 85 feet above sea level.

By HUMBOLDT and DE CONDOLLE it is considered as solely of American origin, and it had been long and extensively cultivated in many parts of that continent before European discovery.

It is always an annual, susceptible to frost at every stage of its development ; the stem is erect with spreading leaves, and differs from that of other grasses in the fact of its solidity. The extraordinary variations in appearance and habit of growth may be judged form the fact that some descriptions state that the plant only reaches two feet in height, while other varieties sometime attain twenty feet, and in the West Indies, plants of thirty feet have been reported. As 60 per cent. of the whole maize crops of the world so far as ascertainable are grown in the United States. it may be convenient to consider separately the varieties usually produced in that country, dealing later with some of the very different products of other lands.

Dr. E. LEWIS STUYVESANT is quoted in both the encyclopedias mentioned as dividing the maize grown in the United States into seven prominent groups as follows:

1) Dent or Field Maize (*Zea indentata*). This is the form commonly produced in the United States, and has many sub-varieties differing widely in the size of plant, and in the appearance of the cob. The grain is flat sided, quite horny on one facet, but indented or grooved with a softer surface on the other side. The colour may be yellow, white, red, or a variegated mixture, which is known as mixed corn and forms the chief basis of all trading in United States maize (always styled *corn* in that country). This group of varieties is grown in most regions of the United Srates east of the Rocky mountains with the exception of the Northern Section, where 2) *Flint* Corn (*indurata*) is substituted ; this variety matures more quickly and is therefore better suited for the climate of a region where summer is of comparatively short duration.

3) *Soft Corn* (*amylacea*) without the horny surface, formerly grown extensively by Indians in both North and South America.

4) *Sweet Corn* (*saccharata*) has a translucent appearance in the grain, which when ripe, is much wrinkled. This is preeminently a garden vegetable, and is usually cut and cooked in the cob, which is well filled ; the grain has a soft and silky appearance. Canned sweet corn is an important article of domestic trade in the United States and Canada.

5) *Starchy Sweet Corn* (*amylacea saccharata*) has the lower half of the grain of a starchy character, and the uppermost translucent. The three last mentioned groups are usually white in colour.

6) *Pop Corn* (*everta*) has an almost completely hard surface, and

when heated, the inside kernel, containing moisture, explodes; this grain is of very small size.

7) *Pod Corn* (*tunicata*) has a separate husk for each kernel, differing completely from other groups, where the sheath of each cob forms a covering for a large number of grains.

Besides the United States crop, maize is important in many other countries. It can be grown within the tropics from sea level up to a height of 6000 feet, but does not flourish well where nights are cool.

It is almost always the first crop to be discontinued as higher elevations are reached, and in Southern Europe where it is so widely cultivated, a limit of about 2000 feet above sea level is imposed upon maize cultivation. Beyond a North Latitude of 45° to 50° it ceases to yield satisfactorily, but if planted in deep, rich soil on river bottems in sufficiently warm climates, maize may produce 50 000 to 80 000 pounds of green forage, or 8000 to 12 000 pounds of dry material per acre.

The character of the grain produced in Southern Europe does not show as many divergencies as in America; it is chiefly of a bright, or dull yellow colour, and rounded in shape, as distinguished from the flat variegated product known as Mixed Corn in the United States.

Some exceptions occur in Roumania and in Russia. The size of the grain varies in these countries, some growths being very small, and occasionally flat sided, while in Caucasia the maize is very similar to Mixed American, in size and colour.

The relative importance of the maize crops in the chief producing countries is indicated in the subjoined table. The data considered are those for 1923 and 1922 in the northern hemisphere, and 1923-24 with 1922-23 in the southern hemisphere. Averages of the preceding five years' period are also given. Data are in arrear for Russia, Mexico, as well as India, where estimates of the maize yield are not always made annually.

The crops in Argentina, Brazil, and South Africa are harvested chiefly in March and April.

As already mentioned the United States maize production is about 60 % of the ascertainable world yield. Next comes Argentina, rivalled by Brazil in some seasons, each of which countries may be set down as growers of about 4 % of the world's maize yield. We then come to Rumania with about 3 % on an average, but in 1923 almost on a par with the two South American Countries just mentioned. South Africa, Java and Egypt each provide ordinarily about 1 % of the aggregate, a level nearly approached by Italy and the Serb-Croat State. Other South European countries grow only a small quantity and in the central European zone only a limited importance is attached to the maize crop, as the colder climate imposes restrictions.

Indian and African natives grow maize in considerable quantity for their own requirements, of which no statistical data are available, and China, where the estimated production is about 1 % of the world's ascertainable yield may have really a much larger share.

The maize of Argentina and of Brazil resembles that of South Europe

Data of yields of Maize in the chief production countries of the world, so far as ascertainable.

Countries	In thonsand quintals (1)			Percentage for the 1923 crop		Yield in quintals per hectare — in 1922
	1923 & 1923-24	1922 & 1922-23	Average Yield 1917 to 1921 & 1918 to 1922	1922 = 100	Average = 100	
Bulgaria	6,834	3,932	4,739	174	144	7.4
Spain	6,077	6,816	(1) 6,688	89	91	14.5
Serb-Croat-Slovene State	21,536	22,819	(1) 22,216	94.6	96.9	11.3
Hungary	14,010	12,377	(1) 10,398	113	135	11.9
Italy	22,378	19,507	22,184	115	100	12.6
Rumania	44,226	29,478	(1) 37,209	150	119	8.2
Russia		17 133	(3) 9,249			
United States	775,847	734,270	720,925	106	108	17.7
Mexico		17,339	(3) 17,400			10.0
India			22,147			
Philippines	4,233	3,722	3,671	114	115	6.8
Egypt		18,671	16,543	153.4	127.4	(5) 18.6
Argentina	68,600	44,732	53,860			12.2
Brazil		51,365	(4) 41,859			
Java and Madura	12,730	12,066	13,570	106	94	7.7
Union of South Africa		13,608	10,715			(6) 7.8

(1) Average 1920-21. — (2) Average 1909-13. — (3) Average 1918-20. — (4) Average 1917-18 & 1919-20 to 1921-22. — (5) Yield per hectare in 1921. — (6) Yield per hectare in 1920.

(1) 1 *quintal* = 100 *kilos* = 220 *lb.*

as a rule, in shape, in colour and size ; some of the grain is of a redder tinge, and is small in size.

In Central and Northern Argentina every garden has its maize plot, besides the hundred acre fields to be seen on every hand, where moisture is sufficient. These gardens sometimes produce excellent crops, and must then add largely to the aggregate results after providing for all domestic requirements of food and fodder. Locust attacks are reported every season but seldom cause any serious general loss of crop.

Practically all commercial transactions in maize (always called corn) in the United States are concluded on classification (grade). The really effective basis for ordinary business is No. 2 grade of Mixed Corn.

On this basis future delivery transactions invariably take place. The following is the official standard description of No. 2 Mixed Corn :

" Number two mixed shall be mixed corn which does not come within the requirements of grade number one mixed, shall be sweet ; shall contain not more than 15 ½ per centum of moisture ; not more than 3 per centum of foreign material and cracked corn, and not more than 4 per centum of damaged corn ; shall not contain heat damaged and mahogany kernels, and shall weigh not less than 53 pounds per Winchester bushel ".

It is perhaps superfluous to give particulars of the standards of Number I Corn, but, as this grade is mentioned above, it may be explained that in Number I grade, the limit of the moisture, is 14 per cent., while foreign material, and damaged grains, are each limited to 2 per cent.; the minimum weight is 55 pounds per Winchester bushel.

On the other hand, for grade No. 3, the limit of moisture is extended to 17 $\frac{1}{2}$ per cent, and other blemishes are allowed in larger proportions.

For interior requirements, doubtless 17 $\frac{1}{2}$ per cent of moisture does not render the grain unmarketable, bur for export to Europe, or other trans-oceanic destination, a moisture content of 15 $\frac{1}{2}$ per cent. is quite the outside limit that can safely be put on board ship. For export transactions it is the moisture content that is of real importance, the natural weight and the percentage of cracked (broken) or damaged grains are of less moment in final disposal abroad.

Grade of Corn.

It is by no means always the case that No. 2 or No. 3 Corn contains so much moisture as is indicated in the grading rules. Naturally this percentage is mostly dependent on the character of the weather during ripening and harvesting. A very dry season, too, may reduce nearly all the crop, over wide areas, to No. 3 grade, owing to deficiency in natural weight, while the moisture content may be much less than even 15 $\frac{1}{2}$ per cent. In such an event, No. 3 grade is available for export.

The grading is carried out by duly appointed Inspectors who receive the license of the Department of Agriculture, after a full inquiry as to their knowledge and capability for undertaking the duties. Complaints as to irregular grading by inspectors or as to misrepresentation or malfeasance after grading by the parties concerned are investigated by the Secretary of Agriculture.

Of the chief cereal products, maize is probably that which contains the highest average percentage of moisture, and consequently is liable to germinate most readily.

In Argentina at some country station may often be seen a large pile of bags containing maize, exposed to the weather with green shoots coming into sight after a day's rain followed by hot sun. This arises from inadequate protection from weather, but in fact, maize requires almost constant inspection, and treatment at certain seasons, if it is to reach an overseas destination in marketable condition. The operation of thrashing, more properly cribbing, is usually carried out immediately before the grain is to be marketed, in every country. On the cob it is much safer; if not shelled it does not appreciably deteriorate in the course of the season.

After harvesting, a certain period is given to drying in the cobs, as may be seen in many Italian villages during autumn, where the rows of golden coloured cobs form an attractive embellishment on the roof or front of the farm house.

In the United States the cobs are stored in long cribs or sheds with open sides, where the air can freely pass, thus bringing about evaporation in cold weather. Unless the drying in cob has been complete, the question of condition will come up at the grading. In ordinary seasons no ocean

shipment of maize grown in the middle western States, made earlier than January, can be trusted to arrive in Europe in merchantable condition.

Again, when the germinating period approaches and the natural course is that of planting the seed, all maize becomes affected, and, if in bulk, has a strong tendency to deteriorate by heating. Therefore, exporters do not buy in the United States after April, until the torrid heat of July is passed. There are two periods of the year when exporters can safely do business, from January to April, and from August until, in November, new maize becomes available and is likely to be mixed in with the old, dry grain.

With these recurring checks on export business, and with the absorption of most of the maize crop for hogs and other live stock feeding, limitations of quantities exported are obviously probable. In fact, at the moment when growers are most desirous of selling, it is unlikely that European buyers will be willing to accept risks of deterioration on the voyage, and, on the other hand, when Europe is ready to purchase with a probability of sound delivery, the farmer has generally disposed of any surplus, and prefers to hold the remainder for his own requirements.

The cases of Rumania and Argentina, are very different. In the first place, the population of those countries is small in comparison with the quantity of maize grown, and although ordinary risks of condition are similar to those in the United States, the practice in the export trade is for shippers to undertake them, so far as the period of the voyage is concerned. The buyer in Western Europe can therefore act with some confidence in purchases of Argentina or Rumanian maize, knowing that the seller for export will take every care to load only grain that, in his opinion, will not deteriorate on the voyage. Relatively to the differing periods of harvest in Rumania and in Argentina, similar restrictions, caused by incomplete ripening and by the germinating period, have to be observed.

A valuable return was furnished to the International Institute of Agriculture by the United States Department of Agriculture and was published in Statistical Notes on the Cereals No. 7, April 1918. The data are those computed by the Department as representing the destined uses for the United States maize crop, under average conditions of quantity and of requirements, in other words, of supply and demand. Almost similar conditions are still applicable in the United States, and the variety of uses adopted is a feature likely to prevail more or less, in many of the maize growing countries. The proportion devoted to feeding live stock must naturally follow the numbers of animals, and the quantities exported, or imported, must depend upon the capabilities of soil and climate, in each country. But the uses set forth in detail by this return are world-wide and thus afford a basis for international consideration of the utilities of maize.

The list of importing countries is a long one but those that receive any considerable quantities from abroad are almost entirely European. In like manner, a number are quoted as exporters, but effective supply on any large scale comes to hand only from Rumania, theUnited States, Argentina and South Africa.

Utilisation of an average maize crop in the United States

(in million quintals of 100 kilogrammes).

Human consumption (in America)	25	
Consumed on Farms by Horses & Mules	185	
» » » » Hogs	184	
» Milch cows	59	
» Cattle	65	
» Sheep	15	
» Poultry	25	
for Seed	6	
Unspecified purposes	11	575
Employed in Manufactures for maize meal	62	
glucose & starch	19	
distilling	5	
Malt	4	
Fodder in cities	30	
Exported	11	
Unspecified purposes away from farms	7	129
Total		702

Of these four leading exporters, Argentina is the steadiest contributor, Rumania, the United States and South Africa occasionally fall into insignificance as exporters of maize. Before the war, Russian supplies were of some moment, but so far there is little sign of their renewal, indeed during 1922 Russia imported 805 thousand quintals of maize.

Table of maize imports into the chief importing countries during the calendar years

(in thousand quintals).

Importing countries	1923	1922	1921	1920	1919
Germany	2,534	10,854	18,705	4,080	no figures
Austria	735	911	1,702	(1) 1,302	333
Belgium	4,041	4,174	4,911	2,662	302
Denmark	3,341	4,381	4,668	2,491	1,961
France	5,638	5,346	3,346	4,454	1,369
Great-Britain and Ireland	17,545	18,898	18,673	17,191	8,566
Italy	4,442	5,045	4,563	3,200	1,067
Norway	973	901	896	963	997
Netherlands	7,101	8,795	9,001	3,894	2,205
Poland	27	133	451	no figures	no figures
Sweden	663	505	1,063	386	813
Switzerland	1,327	1,272	1,297	243	1,340
Tcekoslovakia	604	982	1,989	80	89
Canada	2,270	3,359	3,130	2,708	1,024
Australia	669	140	7	48	153

(1) Last six months.

Table of maize exports from the principal exporting countries during the calendar years 1910 *to* 1923 *inclusive*

(in thousand quintals).

Exporting countries	1923	1922	1921	1920	1919
Rumania	6,694	2,916	7,691	4,400	6
United States	10,716	41,559	32,761	4,512	2,814
Argentina	29,474	27,713	28,349	44,107	22,271
Union of South Africa.	5,119	2,468	3.526	316	1,117
Totals . . .	52,013	74,656	72,327	53,335	26,208

In the April 1924 Number of *United Empire* (Vol. XV, new series No. 4, p. 263) an address by Mr. G. LARPENT, head of the Immigration Department for Rhodesia, is quoted. He said that the staple crop of Rhodesia is maize. The temperate climate and the rich soils of Rhodesia have improved American seed to such an extent that inquiries for Rhodesian maize seed had been received from Florida, California, Mexico, and British Colonies. It was, he said, the great hope and aim of maize growers in Rhodesia to become suppliers of maize seed to the rest of the world.

The maize crop of Southern Rhodesia in 1922 was 1 315 thousand quintals according to returns made to the Government, not including the very considerable quantity grown by the natives for their customary food requirements.

Maize is generally regarded as an uncertain crop, chiefly because it is very liable to suffer from extremes of temperature. In the United States an early frost may curtail the yield in some regions very considerably, but the most serious danger is from continued drought and heat in August and September when the crop may be "fired" on important areas. The same risk occurs in Argentina where a period of scorching weather in January 1911 sufficed to ruin the crop ; the whole yield was only 7 million quintals as compared with an average of fully 40 millions. The author had an opportunity of seeing the havoc thus wrought in a single week on apparently promising maize crops in very important districts, at the time mentioned.

It is naturally very seldom that damage of this kind is sufficiently widespread to produce such results, but partial drawbacks arising from extremes of temperature do affect maize crops in nearly every season, though local injury is often compensated by plentiful yields in other parts of the same country.

A maize crop in full flower is one of the most striking of rural scenes ; from this and other characteristics, partly indicated above, it may be regarded as one of the most interesting of the crops of the world.

J. H. H.

349. Improved Rice Varieties in Italy.

NOVELLI, N. Il miglioramento della semente di riso. *Il Giornale di risicoltura*, Year XIV, No. 2, pp. 17-39, figs. 19. Vercelli, 1924.

During the last ten years, the average increase in crop yields for rice in Italy, has risen from 30.2 quintals per hectare in 1912, to 41.4 q. per ha. in 1923. It is not unusual to obtain 50 q. per ha. on rice plantations and a maximum of 70-75 q. per ha. has been reported. This increase has been attributed to careful manuring and improved cultural methods, but more especially, to seed selection.

The " Stazione di Risicoltura " at Vercelli has already done valuable work along these lines (1). The " Chinese Originario " distributed by this Station in 1903, and subsequently the " Nero di Vialone," the " Bertone ", and " Ostiglia " may be mentioned as the principal varieties responsible for increased yield.

The following recent varieties are also worth special attention : —

Japanese varieties. — The " Onsen " has given satisfactory results : — high yield, resistance to disease ; commercial value similar to " Chinese Originario ", still more evident after reproduction and consequent earlier maturity, harder grain, and higher percentage of clean rice. This variety grows well on all types of soil, and is suitable for new plantations ; it is readily transplanted.

Early varieties : The " Originario Precoce 6 " or " OP 6 ", obtained by the Sancio monks at Trino (Prov. Novara) from the " Chinese Originario " is of medium size, average yield, fine quality grain, and suitable for second or third year plantation, on soil not too rich in organic matter and comparatively heavy.

" *Precoce Dellarole* ", obtained by Sig. Nicola DELLAROLE, at Vinzaglio (Prov. Novara) and exhibited at the " Stazione di Vercelli " in 1914 ; has given satisfactory results (ripens very early and grain superior quality), but does not reproduce successfully.

" Precoce giallo Ardizzone ", obtained by P. ARDIZZONE at Cascina Angossa (Vercelli), distinguished by the reddish yellow colour of the straw which facilitates handling.

" Precoce Novella " or " Precoce Allorio ", obtained by the rice planters NOVELLA and ALLORIO in Vercelli. Inferior yield to " Originario " and gives good proportion of cleaned rice ; somewhat less resistant to disease and lodging, but earlier ripening and superior grain ; suitable for late sowing.

" Precoce Maratelli ", obtained by M. MARATELLI at Asigliano (Prov. Novara) ; more compact, than " Originario ", erect, very resistant to lodging, leaves large and characterised by inclined slope towards the panicle. Although somewhat less dense than " Originario ", the foliage is abundant and forms a good soil covering. This variety grows well on various types

(1) See *R.* 1915, Nos. 270 and 1277 ; *R.* 1916, Nos. 54, 370, 511, 814 ; *R.* 1917, No. 196 ; *R.* 1918, Nos. 755 and 756 ; *R.* 1919, No. 456 ; *R.* 1921, No. 1113 ; *R.* 1922, No. 191. (*Ed.*)

of soil provided that it is not too rich in organic matter ; matures about 10 days earlier than " Originario " but slightly lower yield ; grain opaque, large, and good quality. Recommended for cultivation and further selection.

" Precoce Vittoria ", obtained by P. SANCIO at Trino, similar to " Originario ", but earlier maturing ; suitable both for old and new plantations and is highly recommended.

Varieties recently introduced : " Americano 1600 " received by the Stazione di Vercelli from the U. S. Department of Agriculture and tested by the author from 1921 onwards. This variety is of Japanese origin and has already proved successful in Italy, resembling in many ways the " Originario " as regards vegetative development. It is, however, more resistant to lodging and ripens earlier, and gives a higher proportion of clean rice (83 % commercial rice and 72° " camolino ") One evident advantage lies in the fact that the seed has not yet been mixed with red grain.

Other varieties introduced into the Station in 1923 from Japan have been tested in several localities. Those which have proved satisfactory as regards acclimatisation, have been given further trials. F. D.

350. **Sugar Production in England.**

Louisiana Planter and Sugar Manufacturer, Vol. LXXII, No. 6, p. 107. New Orleans, 1924.

It was stated by BALDWIN that England was capable of growing 500 000 acres of sugar ; this might be questioned, but progress has been made, although slow. In Norfolk beets were grown that had 19 % sugar content. The Cautley Factory worked up in 1921, 19 000 tons of beets, in 1922, 41 000 tons and in 1923, 55 000 tons, with a white sugar output for the three seasons of 1900, 4300 and 7000 tons respectively.

The Kelham factory was opened in 1921-22 and worked up 25 000 tons of beets, with an output of 2000 tons of sugar.

Each of these factories has this year an area of 15 000 acres under beets, and expects to produce 15 000 tons of sugar.

On July 20, 1922 home-grown sugar was freed from the import duty of 25s. 8d, and also from the rate of 21s 4 d. on sugar from British Colonies.

Raising the sugar tonnage in the homeland and the colonies will materially aid England, but as the country consumes from 17 500000 to 2 000 000 tons of sugar per annum, England will still be dependent upon other nations for a large part of her sugar supplies.

W. S. G.

Starch Crops.

351. **The Potato in Brazil.**

Producção e commercio da batata no Brasil. *Revista Agricola, Industriale e Commercial Mineira*, Vol. 1, Part 6, p. 467. Bello Horizonte, 1923.

According to the data collected by the Ministry of Agriculture of Brazil, the potato crops in the country amounted to 190 853 tons in 1921 ;

286 350 tons in 1922 ; 208 408 tons in 1923. In 1921, 2180 tons were imported and in 1922, 2554 tons. About 150 000 tons are consumed annually. The principal potato-growing States are : São Paulo, Minas Geraes, Rio de Janeiro, Paranà, Santa Caterina, Rio Grande do Sul. About 32 000 hectares are under potatoes, the average production being 90 quintals of tubers per hectare. The average price paid for imported potatoes in 1922 and 1923 was 511 *reis* per kg. The chief importing countries are : Germany, Argentina, Denmark and the United States. No potatoes are allowed to be imported into Brazil unless they are accompanied by certificates declaring them to be entirely free from all parasitic diseases ; further, they are subjected to examination by the " Serviço de Inspecção e Vigilancia Sanitaria do Instituto Biologico de Defesa Agricola ". F. D.

352. The Sweet Potato in South-Western France.

BEILLE, L. (Professeur à la Faculté de Médécine et de Pharmacie de Bordeaux). La patata douce dans le Sud-Ouest de la France. *Revue de Botanique appliquée et d'Agriculture coloniale*, Year 3, No. 28, pp. 818-822. Paris, 1923.

Since 1905 the author has cultivated at Bordeaux, a variety of sweet potato coming from Dahomey, and also another from Martinique. Plants obtained showed an average weight of 5.5 kg., 4.2 of which consisted of leaves and 1.3 kg. of tubers, which gives an indication of the composition. A description is given of the methods of cultivation and conservation best adapted to the prevailing conditions in S. W. France.

R. D.

Forage crops.

353. Investigations on Leguminous Fodders in India.

I. HEARST COLE, E. Some Problems on Fodder Production in the Punjab. *Agricultural Research Institute, Pusa Bulletin, No. 150*. pp. 28-31. Calcutta, 1923.

I. *Problems in fodder production* :— The question of improvement of arable and pasture lands and economic methods for feeding stock has been studied at Coleyana (Punjab), India under the authors direction. The stud farm has been worked on a six year rotation : — *a*) grass, 2 years ; *b*) crops, 2 years ; Rabi season, September-April (oats, *Trifolium resupinatum*, *Trifolium alexandrinum*) ; " Kharif ". April-September (*Sorghum vulgare* Pers., *Cyamopsis psoraloides*, *Phaseolus aconitifolius* Jacq. and maize ; *c*) lucerne, 2 years.

This method of rotation provides an abundance of organic matter for the cereals, and the crops clean the land for lucerne which in turn leaves the soil rich in nitrogen for the next grass crop. Under prevailing conditions in the Punjab, it is estimated to obtain 1 maund (1) of hay from 10

(1) Maund = 82 lb.

maunds of green lucerne in the colder weather and double in the heat. Consequently it is preferable to feed green whenever possible. The average yield of seed in a normal year is about 1 maund per acre. Satisfactory results were obtained on a test plot with lucerne broad-casted with *Pennisetum cenchroides*, Rich.

Grassland was certainly improved in quality by the addition of *Trifolium resupinatum*. The use of the tandem disc cultivator and tractor is advised previous to broadcasting and has given an increased yield. *Tr. alexandrinum* has proved a good fodder, yielding 1 maund of hay for every 9-10 maunds green fodder. The author considers this species somewhat preferable to the preceding species ; it grows well and gives at least three cuts on well prepared land.

The seeding problem is a continual difficulty in the Punjab and no definite conclusion has get been reached. It is considered advantageous once this difficulty is overcome, to employ the *Trifolium* species in place of *Melilotus indica* and *M. alba*, hitherto cultivated in this area Conditions necessary for seed formation are being investigated at Pusa.

Tests are being made with several indigenous leguminous plants of possible use as fodder crops, amongst these *Rhynchosia minima* D. C. on cotton areas, is apparently attractive to horses. Also *Lathyrus aphaca* L. found amongst wheat and lucerne is probably of value. Other forage plants still present a field for investigation.

II. *Improved method of lucerne cultivation* : — Experiments have been undertaken at the Pusa Research Institute to discover the best method of intensive cultivation to obtain the largest yield in a small area. The importance of a thorough knowledge of the morphology and physiology of the plant cultivated has been proved, as well as the value of selection of suitable varieties. For example, the analyses of lucerne hay shows the value attached to leaf preservation.

	Albuminoids	Soluble carbohydrates	Moisture	Ether extract (fats)	Woody fibre	Soluble mineral matter	Sand	Albuminoid nitrogen	Total nitrogen	Albuminoid Ratio
Baled lucerne (leaves intact).	15.48	46.30	3.14	3.32	17.70	11.83	2.23	2.48	2.98	1 : 3.5
Lucerne ropes (leaves partially destroyed)	11.71	43.87	5.00	2.90	27.95	8.10	0.47	1.87	2.19	1 : 4.3

Trials have been made with different varieties and satisfactory results obtained with the Hunter valley lucerne of Australia and the Kalianpur from Cawnpore. The " Kandahar " was found adaptable to the high temperature of the frontier valley but not suited to colder climates.

As regards the improved system of cultivation, the usual method of growing on ridges with channels for irrigation has been discontinued owing to low yield, and other economic disadvantages. The lucerne is now grown on flat beds 2ft wide with 1ft irrigation channels between. Seed is sown both on beds and in the channels with no bare ground visible. This has

resulted in increased yield, conservation of soil texture, water saving, and reduced cost of weeding. The stand survives also the hot weather and rains and serves for a second year's growth. The plants in the trenches die out, however, during the rainy season. The irrigation channels act as drains and help to maintain the soil aeration. Apparently the heavy monsoon of 1922, at Pusa, 62.30 inches of rain, had no deleterious effect on lucerne grown on flat beds. The yield is encouraging:— from a plot sown October 1921, eight cuts up to June 1922 gave a yield at the rate of 70 000 lb per acre. Subsequent results with the application of light dressings of leaf compost has already given an additional increase of about 50%.

The author draws attention to the excellent hay obtained which can be conserved for a considerable time without loss. A difficulty in baling has been overcome by damping overnight and covering with tarpaulin, the importance of using the minimum amount of moisture needed to prevent powdering is accentuated.

Reference is made to the water requirements for intensive cultivation of leguminous crops. This subject has been studied carefully in connection with possible saving in wheat growing. (*Bulletin* 118 *Agricultural Research Institute, Pusa.* "The saving of irrigation water in wheat growing").

III. *Fodder in relation to cotton growing.* — The importance of this consideration has already been proved in Egypt, where berseem (*Trifolium alexandrinum*) as a catch crop on cotton plantations has given decidedly profitable results. Advantage of using *Cajanus indicus* in a similar way in the United Provinces (India) has also been notified. The Indian Cotton Committee has emphasised the desirability of helping to maintain soil fertility thus.

M. L. Y.

354. The Growth of Alfalfa with various Cutting Treatments.

CRABER, L. F. *Journal of the American Society of Agronomy*, Vol. 16, No. 3, pp. 169-172. Geneva, N. Y., 1924.

According to the results obtained at the Kansas and Wisconsin Experiment Stations, the responses of alfalfa to frequency of cutting at various periods of growth are decidedly pronounced, and this plan may serve as a valuable medium for initial investigations on leguminous root reserves. The more frequent cuttings at the early stages of growth compared with less frequent cuttings at mature stages have resulted in a gradual thinning out, a reduction of vigour, and an influx of weeds and grasses. Two annual cuttings taken when the alfalfa was in full bloom, have yielded over a ton more of cured weed-free hay per acre than three cuttings taken on and before the plots were in tenth bloom. It has been found also that hay cut at full bloom stage contained 15.4% protein compared with 16.5% for the tenth bloom and bud stages. Undoubtedly there are other perennial plants which are similarly effected.

M. L. Y.

355. ***Pennisetum clandestinum*, a New Pasture Grass for India.**

ROBERTSON BROWN, W. *Agricultural Journal of India*, Vol. XIX, Pt. I, pp. 32-24. Calcutta, 1924.

For some time past, the " Kikuyu " grass, *Pennisetum clandestinum* has given very satisfactory results in South Africa for fodder purposes and as a permanent pasture grass (1). The author considered it advantageous therefore to test its adaptability to Indian climatic conditions, and reports the encouraging results already obtained at Peshawar Agricultural Station. It is advised to extend cultivation to areas where the average rainfall exceeds 20 inches, or where irrigation is available, and should prove of distinct value for grazing dairy cattle, and probably superior to *Cynodon dactylon* utilised up to the present in India.

Reference to the comparative analyses made in South Africa with lucerne and other grasses, indicates the high nutrive value of " Kikuyu ". (*Union of South Africa. Dept. of Agriculture, Leaflet No.* 45) (2).

M. L. Y.

356. **Investigations into the Changes which occur during the Ensilage of a Green Crop.**

WOODMAN, H. E. (P. D., D. Sc.) and AMOS, A. (M. A.), (School of Agriculture, Cambridge University) *Journal of Agricultural Science*, Vol. XVI, Part 1, pp. 99-113, bibliography. Cambridge, 1924.

It has long been recognised that the type of silage produced is largely determined by the stage of maturity of the crop. In the case of green " fruity " oat and tare silage there is little doubt that its production depends upon ensiling without wilting of an oat and tare crop in the early stages of maturity, when the oats are in milk and the tares between the stages of full flower and half-formed seeds. Experience indicated that if the crop is too immature and succulent the result may be the so-called " sour " silage.

Experience and experiment point to the following generalisations in regard to the influence of the degree of maturity of crop on the quality of silage :

i) " Sour " silage results from very immature and succulent crops.

ii) Green " fruity " silage from crops in early to medium maturity.

iii) " Acid brown " silage from fairly mature crops.

For the experiment, a crop of oats, tares and beans was selected ; the crop was cut at three different stages of maturity and ensiled quickly. The only varying factor was that of maturity. In no case was the crop damaged by decomposition of the basal foliage.

(1) See *R.* 1922 Nos. 711, 1924. (*Ed.*)

(2) See also analyses in Rhodesia, *R.* 1922, No 1294. (*Ed.*)

The crop was cut and ensiled between the following stages:

June 14. Oats just flowered; June 23. Oats at milk stage.

June 30. Oats all in milk. July 12. Glumes changing from green to yellow and grain passing out of milk stage.

The silos were opened on November 7, 14, 21 in the same order as that in which they were filled.

Analysis showed the following differences in losses of dry matter:

Maturity of crop	Very immature	Early maturity	Daily mature
% loss of dry matter	9.7 – 11.8	8.6 – 9.0	5.8

It will be seen that the loss of dry matter decreased as the maturity of the crop increased. These results confirm the earlier finding of the authors, and that the production of the "acid" type of silage is associated with the least loss.

In the case of oat and tare crops it is now possible to predict the type of silage at the time of filling the silo, and for this reason it is very probbable that the undesirable "sour" silage will disappear, and the two kinds which will be made will be green "fruity" and "acid brown" silage.

The results obtained with these two types may be summarised as follows:

	Green "fruity" silage (mean of 8 trials) % gain or loss	"Acid brown" silage (mean of 3 trials) % gain or loss
Dry matter	— 11.2	— 7.7
Crude protein	— 8.2	0.0
Ether extract	+ 52.4	+ 45.0
N-free extractives	— 19.1	— 14.7
Crude fibre	— 5.5	— 6.0
Ash	— 9.2	0.0
True protein	— 41.0	— 28.4
"Amides"	+ 85.3	+ 96.0

The losses in crude protein and inorganic salts will be noted in the case of "fruity" silage, compared with the "acid brown" variety where they are nil. Conditions of immaturity seem to favour the splitting up of carbohydrates and true protein.

It may be said that cutting the crop in early to medium maturity in order to make "fruity" silage, results in ensiling a smaller weight of forage per acre than if cut at a maturer stage for "acid brown" silage. Against this must be set the fact that green "fruity" silage is superior to "acid brown" in palatability, digestibility and nutritive value. Investigations carried out at Cambridge have shown that the production starch equivalent of 100 lb. of dry matter of green "fruity" oat and tare silage is 45.6, whereas that of "acid brown" oat and tare silage is only 31.4.

W. S. G.

357. **Cotton Cultivation in the French Colonies.**

CHEVALIER, A. Etat actuel de la question cotonnière dans les côlonies françaises. *Revue de Botanique appliquée et d'Agriculture coloniale*, Year 3, No. 23, pp. 793-818. Paris, 1923.

The author describes the present position of cotton cultivation and the possibilities for this plant in each of the French Colonies. The different projects for development are discussed relative to the cultural, economic and labour conditions, and a comparison is made with methods of cultivation employed in other colonies where conditions are similar.

R. D.

358. **Economic Conditions of Cotton Cultivation in North Africa** (1).

TRABUT. Conditions économiques de la culture cotonnière en Afrique du Nord. *Comptes Rendus des Séances de l'Académie d'Agriculture de France*, Vol. X, No. 3, pp. 105-107. Paris, 1924.

The author states that cotton can be grown on all the coast plains of North Africa, and even beyond them up to a height of 700 m. Cotton has always been cultivated by the natives over small areas of the oases. Practical experience has shown that 200 to 700 kg. of fibre can be obtained per hectare.

In 1923, 14 034 kg. of seed-cotton, or 4 678 kg. of lint, and 9 356 of seed, were grown on eight hectares at the Ferme Blanche (Algeria). Since the cotton fetched 20 fr. per kg. and the seed 35 fr. per 100 kg. the whole crop sold for 96 834 fr. On deducting the cultivation expenses, or 17 262 ft., it is seen that the profit amounted to 9946 fr. per hectare.

Cotton cultivation is, however, localised in the neighbourhood of Orleansville and in the district of Penegaux, where an active propaganda is being carried out by the Experiment Station of the Ferme Blanche which distributes the selected seed of tested varieties of Egyptian cotton. The demand for this selected seed is small, owing to its high price, as farmers do not yet realise its value.

R. D.

359. **Cotton in Indo-China.**

Le Cambodge économique et Culture du cotonnièr. *Bulletin Economique de l'Indo-Chine*, Year XXVI, No. 162, pp. 380-382. Hanoi-Haiphong, 1923.

Cotton Growing. — From time immemorial the Cambodian has been a grower of cotton, which he calls "Krabas", the cultivation being confined to the river flats. Since 1914 the energetic work of M. Martin DE FLACOURT, Chief of the Agricultural Service of Cambodia, has extended this cultivation to the fertile red lands of Kompongchan; the success achieved in these plantations has added to the possibilities of Cambodia Cotton.

The cotton grown chiefly in Cambodia is *Gossypium hirsutum* in-

(1) See *R.* 1923, No. 652 (*Ed.*)

troduced originally from America, and which is the only species cultivated on a large scale along the flats of the Meikong and Bassac rivers; this is the *Cambodia Cotton* of India, where it was introduced many years ago, with excellent results (1) Two other varieties are here and there met with; according to documentary evidence these are Krabas Sang-Ke, a type intermediate between *Gossypium arboreum* (L.) and *Gossypium indicum* (Lark) and "Krabas Sampau" which at present has no definite botanical classification.

Cambodia Cotton (*G. hirsutum*) grows to a bush of 2 ½ to 4 feet in height and is planted on the river flats, after the subsidence of the floods, in August and September.

As soon as the water disappears, leaving the flat land visible, Cambodians set to work to plough, repeating the operation ten to fifteen days later, and sowing the seed at once so that the young plant may derive benefit from the later rains.

Sowings are made in lines fully a yard apart, with a space of nearly 3 feet between the plants, which are placed in holes about 4 inches deep. The seed is previously soaked for 24 hours, and ten seeds are put in each hole.

In fourteen days the plant is sufficiently advanced for thinning out, three or four of the best plants are left and the others destroyed.

When this work is finished, the native grower leaves the rest to mature, until picking begins in the first fortnight of March, continuing until the setting in of the rains.

Every three of four days the women gather the ripe bolls, which are laid out to dry and sent to the ginnery subsequently.

On the red lands cotton growing began in 1914, as already mentioned; the methods of cultivation are practically the same as on the flats, but a more complete preparation of the soil is required; as it is not necessary to await flood-subsidence, planting is possible in July or early August, and picking then takes place in January or February, the driest months in Cambodia, which is the most favourable time for cotton picking.

Cotton yields and trade. — In good years the yield of cotton is from 7000 to 8000 metric tons, but it fell off slightly in 1920 owing to the unfavourable season.

Much difference of opinion has always existed as to the value of Cambodia cotton; French spinners, before the war, complained of the short staple, preferring American and Egyptian varieties.

Opinions have been more favourable of late but most of the Cambodia cotton exported is shipped to Japan.

A letter dated 29 April, 1923 was received from His Excellency the Governor General of Indo-China with reference to the Institute's Monograph "The Cotton Growing Countries". His Excellency communicated figures of export during 1920 1921, 1922 to supplement those quoted in the Monograph mentioned. These data are as follows

(1) Martin de Placourt Possibilités du Cambodge au Point de vue Cotonnier (1)

Exports of Cotton from Indo-China.

	Unginned Cotton	Ginned Cotton
	Thousand pounds	Thousand pounds
1920	3,045	5,116
1921	3,229	6,222
1922	3,066	4,656

The letter continues:

"The cotton question in Indo-China is the order of the day, and is the subject of particular attention among the technicians of our Services. The area under cotton is probably susceptible of very considerable enlargement in some parts of the Indo-Chinese Union, but this development is contingent on results of much prepartory study and work continuing for a period which cannot be defined. I shall take care to give you timely information as to progress." J. H. H.

360. **Cotton Growing in Australia.**

JOHNSON, W. H. (Late Director of Agriculture, Southern Provinces, Nigeria). *Bulletin of the Imperial Institute*, Vol. XXI, No. 4, pp. 590-607. London, 1923.

The author, draws attention to the fact that, although Australia is slightly larger than the United States, and one-third of it lies in the tropics, extensive areas are not suitable for cotton cultivation on account of the scanty or badly distributed rainfall. The soil and climate however, in large portions of Queensland, Northern New South Wales, North West Australia, the Irrigation Settlements and probably also the Northern Territory, are well adapted for cotton cultivation, but experiments will have to be carried out to decide whether the crop can be profitably grown on a commercial scale, to determine the best planting season, and the best varieties for particular districts. Careful seed selection will have to be practised and the seed supply controlled in order to prevent mixture of varieties. W. S. G.

361. **Cotton Growing in Eritrea.**

GARAVAGLIA, R. C. Il cotone in Eritrea. *L'Agricoltura coloniale*, Year XVIII, No. 1, pp. 1-12. Florence, 1924.

A general report of the progress made in Eritrea since 1902, in cotton production, with a description of the prevailing conditions climate, soil, etc. and the difficulties to be overcome. M. L. V.

362. **Note on Egyptian Cotton.**

The Farmers' Weekly, Vol. XXVI, No. 672, p. 1060. Bloemfontein, 1924.

With reference to the gradual deterioration and reduction in yield per acre of Egyptian cotton, it is suggested that this may be due to the mixture of seed at the ginneries. A case is mentioned where it was found that, out of 4000 sacks (270 lb.) of seed, only 40 sacks were fit to be sold for

seeding purposes owing to the extensive presence of Indian seed. This is attributed largely to the fact that many natives obtain their seed through money-lenders, who buy the sweepings of the ginneries to sell to them. The ginneries cannot guarantee to supply unmixed seed unless a price is paid which will cover the extra care and time required.

Egyptian cotton is often made up into pressed bales of 700 lb., as it has been found possible to make bales of roller-ginned cotton of that weight measuring 35-38 cubic feet. W. S. G.

363. **Utilization of Pima Cotton.**

WILLIS, H. H. (Cotton Specialist, Bureau of Plant Industry). *Bulletin No.* 1184, pp. 25, Plates 13, bibliography. Washington, D. C. 1923.

The special variety of cotton called Pima is better adapted to the Arizona and California conditions than any of the Egyptian varieties. The first commercial planting of 275 acres of this variety took place in 1916; the area planted in Arizona and California in 1920 amounted approximately to 250 000 acres.

The author's object was to study some of the objections current among manufacturers regarding the production, the textile qualities and the utilization of Pima cotton, as found during an investigation carried out by the Bureau of Plant Industry, the Bureau of Agricultural Economics and the Arizona Pima Cotton Growers.

As a result of these inquiries the following conclusions were reached: —

Pima Cotton has been manufactured successfully into tyre yarns and fabrics, balloon cloth and airplane fabrics, where strength and elasticity are the chief requisites. The cotton is being manufactured into fine yarns, lawns, voiles, etc., the yarns made of Pima cotton when mercerized are as lustrous as those made from Sakellaridis or Sea Island cotton.

The method of ginning should be studied and improved so as to avoid an excess of seed and hulls in the lint; the quantity of rough, ropy, tangled cotton should be reduced. The cotton should be stored as soon as possible after ginning so as to avoid damage.

Field inspection and segregation will prevent the mixing of inferior cotton from small unfavorable patches with cotton grown under favourable conditions. Such a system properly carried out will reduce the variations in staple, the high percentage of waste and the number of mixed bales now met with by manufacturers.

Many of the criticisms offered by manufactures can be entirely avoided by proper production methods. W. S. G.

364. **The Commercial Classification of American Cotton.**

PALMER A. W. (Specialist in Cotton Marketing, Bureau of Agricultural Economics). *Circular 278, U. S. Department of Agriculture*, pp. 35, figs 19. Washington, D. C. 1924.

The Circular describes the methods of grading and classification of American cotton as used under the United States cotton standards act of March 4, 1923.

The subject is treated under the following heads : Elements and purposes of cotton classification ; classification according to grade character, and staple length ; the relation of classification to value ; special conditions affecting the value of cotton ; sampling and handling of samples : light and weather conditions and their influence. W. S. G.

365. The Cultivation of *Agave Cantala* in Indo-China.

I. — CHEVALIER, A. Note préliminaire. *Revue de Botanique appliquée et d'Agriculture coloniale*, Year 3, No. 27, pp. 719-722. Paris, 1923.

II. — CAVILLE, A. (Ingénieur en chef honoraire des Travaux Publics de l'Indo-Chine). Essais de culture en Annam. *Ibid.*, pp. 722-726.

III. — VERNET, A. (Chef du laboratoire de Technologie de l'Institut scientifique de Saïgon). Etude technique des fibres. *Ibid.*, pp. 727-732.

I. — The whole series of textile agaves has been tried in the Lower and Central parts of Tonkin (French Indo-China), but with such unsatisfactory results, that at the time when the author travelled through the country, only two or three of the colonists were still cultivating sisal.

M. CHEVALIER, however, crossed one district where the wild vegetation is characterised by its pronounced xerophily ; this is the coast portion of Phantiet and Phanrang, a district lying to the South of Annam, and only a few kilometers broad, although it is 100 km. long. Here, the annual rainfall ranges from 500 mm. to 1000 mm., and as the climate is distinctly tropical and very dry, the conditions are well suited to the agave.

Agave Cantala has been acclimatised in this district for centuries ; it is sometimes cultivated on a small scale by the natives who grow hedges of it. The author (after stating the origin of this species), advises that it should be cultivated in preference to *A. sisalana* and *A. elongata* which produce smaller crops. It is very possible that selected lines of *A. Cantala* may exist, therefore it would be well to choose for planting suckers growing on vigorous plants rich in fibre, and as much alike as possible. Amongst agave plants that had long been naturalised at Tourcham, M. CAVILLE (II) found individuals fulfilling all these requirements and giving high yields of fibre (see III).

II. — Since 1920, there has been, in South Annam, a plantation of *A. Cantala* Roxb. covering 600 hectares.

The percentage of dried fibre (bleached with chloride of lime), obtained from this plant is 3.69, or allowing 18 to 20 % of the waste during the extraction of the fibre by machine, a net yield of 3 %. The leaves of *Cantala* weigh on an average 1.500 kg. and thus produce 45 gm. of fibre. The Annam variety bears a large number of leaves ; an average of 40 leaves annually having been cut from plants 6 years of age. A crop of 1.800 kg. of dried leaves per plant per annum can therefore be counted on.

(1) See *R.* 1922, No. 168, and *R.* 1923, No. 795. (*Ed.*)

The site of the plantation was originally covered with forest ; the ground is hillocky, and the soil is a light, sand or clayey-sand remarkable for its lime content. There are 1 200 000 agaves planted at intervals of 1.60 m. in rows 3 m. apart. The rows run parallel to the course of the summer monsoon, and the object of the close planting is to obtain as much resistance as possible to the wind.

According to information supplied by the natives, *A. Cantala* never flowers before it is 5 years old, indeed some have asserted, and amongst them a French colonist, that no flower-spike is produced until the agave has reached the age of 20. If, however, the inflorescence bears few, or no bulbils, the agave throws out a large number of suckers during its life. Suckers (from 0.10 m. to 0.30 m. in length) were collected throughout the country and planted out at intervals of 0.30 m. × 0.30 m. At first, every other service-path was planted with *Leucaena* to provide sufficient shade, but it was found that shade did not suit the suckers. The latter remain in the nurseries for 8 to 14 months according to their size at the time of replanting. The suckers which are 0.20 m. to 0.30 m. long when put into the nursery are planted out (when they are 0.45 m. to 0.50 m. in length), at the beginning of the rainy season, in holes of from 0.30 m. to 0.40 m. square.

The maintenance operations consist in the destruction of any shrubby growth that may be introduced during weeding, and in removing suckers which might exhaust the parent plants. The expenses of these operations are covered : 1) by the nitrogenous manure furnished to the soil by the dung of 600 head of cattle which crop the herbage without injuring the agaves ; 2) by using the suckers for distillation since they contain twice as much alcohol as the leaves.

The figures given by the author prove the plantation to be a very profitable undertaking.

III. — *a) Fibre percentage of the leaves.* — Leaves 3 ½ years old have been known to contain 2.3 to 2.9 % of fibre-bundles that can be extracted by hand.

A total crop of 65 gm. (yield 3.90 %) of raw, unwashed, sun-dried fibre can be obtained by hand-extraction from plants 15 years old with leaves 1.65 m. long (weight of single leaf 1.68 kg.). After the fibre had been bleached with chloride of lime, washed and dried in the sun, the yield of treated fibre was 3.69 %.

Yields of plant of Agave Cantala aged 20 years.

Leaf	Weight	Length	Weight Sun-dried fibre		Weight Stove-dried fibre	
	kg.	m.	gm.	%	gm.	%
1	1.543	1.42	39.850	2.81	41.850	3.15
2	1.235	1.36	39.434	3.19	35.140	2.87
3	1.519	1.55	41.070	2.72	36.880	2.44
4	1.860	1.59	45.812	2.46	34.418	1.85

The foregoing results were obtained from agaves 20 years of age [1] is the last heart-leaf, viz. the youngest leaf, and [4] is the oldest leaf situated out side the rosette.

The following figures refer to crown leaves from young agaves aged 3-4 months :

Leaf	Weight	Length	Weight Sun-dried fibre		Weight Stove-dried fibre	
	kg.	m.	gm.	%	gm.	%
1	0.500	1.29	19.353	2.16	18.862	2.11
2	0.846	1.26	17.993	2.12	17.155	2.02
3	0.924	1.33	23.045	2.49	20.373	2.20

These data show that it is a mistake to limit the estimate to the yield of the leaves borne by young agaves, or by old plants. In order to calculate the industrial return, beginning for instance with agaves four years of age, it would be enough to remove some leaves every 6 months and estimate the increased percentage of textile fibre ; further, in this manner, the age at which agaves pay for working would easily be determined.

b) *Paper-paste from the fibrous bundles.* — The fibrous bundles were treated with soda for two hours in the autoclave under a pressure of 7 kg., then bleached with chloride of lime, washed in distilled water, dried in the stove at 100° C. After these operations, the celulose yield of the stove-dried bundless was 52.81 %.

The following figures were obtained from the microscopic examination of the fibres composing the cellulose paste.

Characters of fibres of A. Cantala.

	First test	Second test
Length of fibres	1.74 mm.	2.08 mm.
Average diameter	0.021 mm.	0.024 mm.
Feltine coefficient	83	87

The fibres of *A. Cantala* are shorter and thicker than those of *A. sisalana*, hence the fibre of the latter species is preferred from the point of view of paper-making. This difference explains why the Sisal fibre is more resistant while the *Cantala* fibre is more flexible.

c) *Paper-paste made from the waste.* — The fibrous bundles when mixed with the cellulose débris make a good paste on the addition of one part of mucilage. The fibrous bundles must be well-cleaned before use.

The retting waste makes a paste having no cohesion which bleaches badly and is thus without any industrial value.

d) *Alcohol.* — Although the fact has not yet been fully explained, the liquid obtained on pressing *A. Cantala* is capable of fermentation with the production of alcohol. In order to throw further light on the problem, it would be necessary to isolate the many kinds of yeast that occur on the leaves. R. D.

366. **Roselle Seed Oil (*Hibiscus Sabdariffa* var. *altissima*).**

GEORGHI, C. D. v. *The Malayan Agricultural Journal*, Vol. XI, Nos. 7, 8, 9, pp. 223-224. Kuala Lumpur, 1923.

Although "roselle" (*Hibiscus Sabdariffa* var. *altissima*) is cultivated primarily for its fibre, it is of economic interest to note that the seed contains about 17 % oil similar to kapok and cotton seed oil. Details of analyses are given which show iodine value 107.3; saponification value 193.1; density at 15.5° C.: 0.923. The residue after expression of the oil, is rich in albuminoids (about 29 %), the nitrogen content being about 4.7 %. M. L. Y.

367. **Sources of Supply of Divi-divi (*Caesalpinia coriaria*), and Tannin Value.**

Journal of the Royal Society of Arts, vol. LXXII, No. 3719, p. 254-255. London, 1924.

General review of the tannin value of divi-divi, the seed pods of *Caesalpinia coriaria*, well-known commercially in the leather trade. A representative analysis of the pods is given: viz. water 13.5 %; tannin 41.5 %; non-tannins 18 %; ash 1.6 %; insoluble matter 25.4 %. Owing to the high proportion of carbohydrates, solutions for tanning are liable to fermentation. The problem of effectively avoiding this fermentation has yet to be solved, although the risk can be materially lessened by the use of antiseptics.

Reference is made to the survey of supplies undertaken by the United States Department of Commerce (Research Division), and particulars are given concerning the leading output, namely in Venezuela (6610 metric tons, export per annum average from 1908-1921) followed by Columbia, Dominican Republic, Haiti, and the Dutch West Indies. M. L. Y.

368. **Tanning Value of Wattle Bark from Ceylon.**

Bulletin of the Imperial Institute, Vol. XXI, No. 3, pp. 466-468. London, 1923.

Barks from the following species received from Ceylon were analysed to determine the tannin content: — *Acacia dealbata*, *A. decurrens*, *A. mollissima*. Results indicate a similarity to the commercial black wattle bark from Natal, with an average of 31 % tannin. The sole exception, *A. dealbata*, although the tannin content is only 23.2 % and consequently

of inferior export value, is of interest owing to the fact that this percentage is much higher than the normal amount recorded for this species (12-18 %).

M. L. Y.

369. **Studies on Hevea Latex.**

I. BELGRAVE, W. N. C. Coagulation. *Malayan Agricultural Journal*, Vol. XI No. 12, pp. 348-370. Kuala Lumpur, 1923.

II. BELGRAVE, W. N. C. and BISHOP, R. O. Some Constituents of Latex. *Ibidem*, pp. 371-379.

I. — The author discusses the state of rubber in latex, theories of coagulation, emulsification, hydrogen-ion concentration, preservatives, and studies the conditions necessary for equilibrium and for separation of latex.

The temperature and volume changes on coagulation are investigated and reasons given for thinking no change of state occurs on coagulation.

Previous theories of coagulation are examined. The theory is put forward that coagulation is normally due to increase of hydrogen-ion concentration, which may be brought about by bacterial action, and that the phenomena met with can be explained by the assumption of an iso-electric region for the protective protein.

The resins are shown to be unlikely to function as emulsifiers in normal latex.

II. — The authors carried out a rough separation of the substances in latex in order to test their effects on the rate of vulcanization of rubber, and also with a view to more detailed work in the future. An account is given of the separation of serum protein on neutralization ; of an alcohol-insoluble nitrogenous body from serum, also of waxy bodies, phytosterols, resin-acids and a lecithin-like substance from alcoholic liquors.

Reasons are given for thinking that some supposed proteins separated are either break-down products, or are different in composition from normal proteins.

W. S. G.

370. **" Cipò " (*Euphorbia phosphorea*), a Resinous-Wax-Producing Plant of Brazil.**

BOMFIM, U. Industria extractiva do cipó de breu. *Chacaras e Quintaes*, Vol. 29, Part I, pp. 17-19, fig. 1. Rio de Janeiro, 1924.

Euphorbia phosphorea, known popularly as " cipó cunaman ", cipo de leite ", " cipó de breu ", " candomble " grows plentifully in the North of Brazil and especially in the State of Bahia. It forms thick bushes which give trouble to the herdsmen as they hinder them collecting their cattle. This plant has been used for various purposes but only on a small scale. It makes impenetrable hedges as the hairs produce intense irritation of the skin) ; it is a medicine for ulcers etc., and yields a resinous wax used for lighting houses. The author draws attention to the fact that as this species of *Euphorbia* is so abundant, it would be well to exploit it commercially, for the resinous-wax is suitable for various uses ; it can be employed as a lacquer, in the place of tar, as an ingredient of varnishes, etc. The

mode of extraction is very simple, all that is required is to cut the cactus-like stems into pieces, and dry them in the sun, or by gentle heat and then scrape off the resinous-wax covering the fragments, allowing it to fall into a vessel of boiling water. The wax melts and floats and can be skimmed off with a spatula, after which it is placed in vessels where it solidifies in about an hour and is then ready for sale. F. D.

371 **Manuring on Coffee Plantations in State of S. Paolo, Brazil.**

GUEDES, G. Adubação dos cafezaes. *Secretaria de Agricultura, Commercio e Obras publicas do Estado de São Paulo. Boletim de Agricultura*, Series 24, Nos. 1-2, pp. 6-9. S. Paulo, 1923.

The author presents the following formulae relative to the manuring of coffee plantations found successful at the "Instituto agronomico" at Campinas (S. Paolo) and also by planters. For plants 4-8 years old, a supplement of litter and leaf mould was employed.

Plants 4-8 years old.

1) Blood 58.9 kg. + coffee pulp ash 30.7 kg. + bone meal 2 kg. + basic slag 10.4 kg. Applied at the rate of 400-500 gm. per tree.

2) Castor oil cake 45.9 kg. + blood meal 25 kg. + basic slag 10.3 kg. + potassium chloride 18.8 kg. (at 550-700 gm. per tree).

3) Coffee pulp ash 38.8 kg. + basic slag 20.7 kg. + ammonium sulphate 40.5 kg. (at 400 gm. per tree).

Plants 9-20 years old.

1) Blood meal 60.8 kg. + basic slag 2.1 kg. + coffee pulp 24.9 kg. + bone meal 5.2 kg.; 350-400 gm. per tree.

2) Castor oil cake 51.8 kg. + blood 23.5 kg. + basic slag 10.6 kg. + potassium chloride 10.1 kg. (500-550 gm. per tree).

3) Coffee pulp 34.9 kg. + bone meal 20.3 kg. + ammonium sulphate 44.8 kg. (at 250 gm. per tree).

4) Litter or leaf mould at rate of 500 gm. per tree mixed with superphosphate (40 %), 14.3 kg. + potassium chloride 33.3 kg. + ammonium sulphate 52.4 kg.

For old trees.

1) Coffee pulp 49.1 kg. + basic slag 34.3 kg. + ammonium sulphate 16.6 kg. (at 100 gm. per tree).

2) Litter or leaf mould at rate of 200 gm. per tree mixed with superphosphate (40 %) 21,5 kg. + potassium chloride 58.4 kg. + ammonium sulphate 23.1 kg. F. D.

372. **Research on the Tea Plant at the Station of Phu-tho (Tonkin).**

DU PASQUIER, R. *Bulletin Economique de l'Indo-Chine*, Year XXVI, No. 162, pp. 429-440, photographs 4. Hanoi-Haiphong, 1923.

In this paper the author, an agricultural specialist appointed to study tea and coffee at Phu-Tho Station, gives an account of the work done there since its establishment (1).

(1) See *R.* 1921, No. 880. (*Ed.*)

The items of the programme of the work instituted at the Agricultural and Forestry Experiment Station at Phu-Tho with the object of improving tea cultivation in Tonkin are as follows :

1) The study and acclimatisation of the cultivated, or, wild species, varieties and races of tea found in Indo-China, or elsewhere.

2) The selection and propagation of the improved types ;

3) The study of the best methods of cultivation.

4) The study of the most satisfactory processes of preparation.

It is not yet possible to form any definitive conclusions from the experiments and observations made at the Station. The author has therefore confined himself to mentioning the work done and the chief observations made there during the first 5 years of its existence and indicating the lines to be followed in subsequent researches.

I. Study and acclimatisation of the cultivated and wild species, varieties and races of the tea-plant found in Indo-China and elsewhere.

The collection at the Station is being enlarged gradually ; at the present time, it consists of the 24 types given in the table (see page 394).

Since several of these tea-plants have not yet reached their normal development, it is impossible to describe them accurately, or give their botanical name.

The Central-Tonkin tea-plant is a cross between several large-leaved and small-leaved forms. The Tien-Yen tea No. 294/20 and 68/18 appears to be *Thea Gilberti*.

The tea of Hoc-Môn (Cochin-China) is a well-defined variety clearly distinct from the *assamica*, or *sinensis*, varieties. The archives of the Station contain no botanical information respecting this tea-plant.

The teas of Ha-Giang, Nghia-Lô, the large-leaved kinds of Mont-Bavi, Phou-Sang, Makomen and Y-Pang all appear to belong to the *assamica* variety and to the group described by C. Stuart under the name of the " Shan group ". They show, however, small differences in the size and shape of the leaves.

As regards the adaptation to soil and climate and the capacity for cultivation shown by the different tea plants, the author can only mention a few points in connection with the tea plants of Central-Tonkin, and those of Cochin-China, Manipur and Assam that have been planted in the trial plots.

The Tonkin tea-plant is the hardiest and least exacting. It grows well, even on poor soils, but unfortunately has serious defects. As it is a hybrid, the plants of even the same tea-garden frequently differ so much in their physiological and morphological characters as to render it impossible to apply the same methods of pruning and gathering.

The habit of the plant is often unsatisfactory, for either all the branches grow together in a bundle, or else they spread out and fall backwards resting on the soil. Bud-formation is very irregular. Nearly all the plants bear a heavy and early crop of fruit which is very harmful to budding ; in fact, many tea-plants cease budding some time before the

Collection of Tea-Plants at the Phu-Tho Station.

Types	No. at station	Date of layering	No. of plants
Indo-China Tea-Plant :			
Cochin China (Hoo-Môn Region) tea	62/18	1/12/18	173
Ha-Giang (Thanh-Thuy sector) tea	63/18	18/11/18	12
Wild tea of Tiên-Yên (Tonkin)	68/18	9/10/18	6
	78/18	25/10/18	
	294/20	9/12/20	102
Tea grown in Central Tonkin	71/18	12/10/18	24
Tea of Hà-Giang, Lao-Tchay Sector	89/18	27/11/18	12
Wild small-leaved tea of Mont Bavi	88/18	25/10/18	2 (weakly)
	242/18	4/10/19	15
Wild large-leaved tea of Mont Bavi	243/19	4/10/19	
Wild tea of region of Thanh-Ba (*Thea Gilberti* A. Chev.)	259/19	5/12/19	24
	289/19	—	1
Tea of Nghia-Lo (Prov. of Yen-Bavi)	442/22	7/10/22	19
Tea of Makonen (5th military territory)	473/23	25/1/23	700 in nursery 178 in nursery
Tea of Phon-San (Trab-Ninh)	488/23	Transplanted le 18/5/25	34
China Tea-Plants.			
Small leaved tea of Canton region	471/22	18/5/23	210 in nursery
Tea of Y-Pang	477/23	23/12/22	88 in nursery
Assam Tea-Plants.			
Manipur tea	128/18	25/1/23	1 050
Assam tea (Betjang type)	129/18	28/12/18	954
Assam tea (Kacharigou type)	137/19	28/12/18	39
Assam tea (Swinlaybury type)	180/19	31/1/19	78
Assam tea (Goiralhi type)	181/19	17/3/19	54
	182/19	17/3/19	99
Pure native Manipur tea	208/19	17/3/19	2
Jokai Assam tea (hybrid of Assam Manipur)	211/19	5/4/19 5/4/19	4
Manipur tea with light-coloured leaves	287/20	2/11/20	33
Manipur tea with dark-coloured leaves	288/20	2/11/20	106

fruits ripen. Of the foreign tea-plants in the trial plots, the best adapted to the soil and climate are the following :

	Proportion of plants not killed by transplanting
Cochin-China tea No. 62/15	80.5 %
Manipur tea No. 128/15	74.5
Assam tea (Betjang type No. 129/18)	65.6

As regards Cochin-China tea, its value cannot be estimated until cultural tests have been carried out and the tea has been prepared.

The teas which do best at present are those of Manipur and Assam which have already long been grown in all the tea-gardens of India and Java, but it is probable that good results will be obtained with the races that have become most acclimatised. The author found in 1922 already, that the tea-plants No. 128/18 and 129/18 had several advantages over Central-Tonkin tea ; in the first place, they bud more regularly and freely, and further, fruit little and late.

II. Selection and propagation of improved types. — The object of tea-plant selection is to obtain types that are homogeneous, fixed and vigorous and produce tea of good quality. They must also be disease-resistant, bud regularly and freely, need no clearly-marked and long winter rest, flower and fruit as little as possible. Further, the plant should not have a thick, bushy habit nor grow too thinly, the branches ought to be regularly arranged round the stem, the primary branches must grow well away from the base of the plant, while the secondary branches should be erect, and never ramify in the same plane forming a " candelabra " structure.

Since, as we have seen, the Central-Tonkin race is essentially polymorphous, it affords the best field for important selection work.

The chief types so far observed by the author (which differ in the shape and colour of the leaves) are as follows :

1) *Assam type* : Large leaves (10-14 × 5-6 cm.) oblong-lanceolate, acuminate, slender at the base, more or less, frilled between the lateral veins ; colour relatively light ; young shoots pale-green.

2) *" China " type.* — Small leaves (5-6 × 2-3 cm.) oval, oblong, dihedric, tough, thick, cuneiform at base, blunt tip which looks as if the top had been cut off, lateral veins little marked, dark on the upper surface and lighter on the lower surface ; young shoots green, sometimes violet.

3) *Type with large round leaves* (10-13 × 7-8 cm.) with short tip, cuneiform at base, convex on upper surface, light green ; young shoots pale-green.

The tea-plants approaching this type usually have spreading, recumbent branches and fruit freely.

4) *Types with small, oval leaves* (8-10 × 4-5 cm.) flexible, straight or slightly convex above, with short tip, cuneiform at base, dark in colour, young shoots green.

5) *Types with large leaves* (12-15 × 5-8 cm.) rigid, dihedric, erect, acuminate, cuneiform at base, with lateral veins prominent on lower surface, convex between the veins, much serrated ; colour, characteristic bottle-green, young shoots green.

6) *Types with violet shoots* : leaves oblong-oval (10-12 × 4-3 cm.) convex beneath, short tip, cuneiform at base.

7) *Types with dark-purple young shoots and young twigs.* — Large leaves (12-15 × 5-7 cm.), oblong-lanceolate often asymmetrical, dentation

irregular, pointed at base, acuminate, colour very dark above, and lighter below.

In tea-plants of this type, the branches are usually badly distributed and the twigs are thick and strong.

S) Type with long, narrow, lanceolate leaves (14-16 × 4-5 cm.), very slender at base, tip long, flat or slightly convex, leaves young and young shoots violet.

In order to propagate these types separately with a view to studying their suitability for cultivation and the quality of their product, the author had recourse to layering from November 1923.

As a result of observations made in 1922, on the Assam and Manipur tea-plants in the trial-plots, the author began his selection work on these types. The most characteristic individuals which approched most nearly to type were transplanted and were cultivated in an isolated position in the coffee and candle-berry plantations.

III. Researches on the best cultivation methods. — The Station at present possesses trial-grounds consisting of 9 plantations covering an area of 15 135 hectares of hillocky ground. The 56 921 plants growing in these grounds are all of the Central-Tonkin types and have been grown from seeds coming from Thanh-Ba (the concession of M.me Chaffanjon), Phu-Tho and Tuyên-Quang.

These plantations if taken together, being cultivated according to the method generally adopted in India and Java, serve to show how far tea-growing can be profitable in Tonkin and prove to the natives the advantage of a more systematic method of cultivation over the rough treatment they give to their tea-plants. In order to give more force to this demonstration, a small plot with 162 plants is cultivated according to Annamite methods.

The studies made during these first 5 years have been directed to: — the care to be given to young tea-plants — sowing *in situ* — transplanting — the removal of the plants — pruning methods — effect of shading — effect of green manure.

This work will have to be continued for several years longer before it is possible to deduce any decided conclusions from the work. The oldest tea plants are not yet 5 years of age, and have therefore not reached their normal development and yield. On the other hand, experiments on pruning and taping (pinching off the small branches after pruning), and on the effect of green manuring, together with the study of the influence of meteorological factors on the growth of the bushes were only began in 1922.

In the article analysed, the author has studied in succession: seeding, germination and shading of the young tea-plants, transplanting, sowing *in situ* — spacing of bushes in plantation, pruning, taping, gathering the leaves and the " tea-flower ", the effect of shading and of green manures.

IV. Researches on the best preparation methods. — The building of a factory for the preparation of tea and coffee has just been began. In this factory it will be possible to make green, black and long tea strictly according to the methods in use in India, China and Formosa. As soon as the author has discovered how far Tonkin is suited for these purposes, he

will modify the existing processes, or devise new ones with a view to getting the best results.

The technical study will also be extended to ascertain : 1) the effect of meteorological conditions in the preparation of tea ; 2) the processes best suited to each variety, or race.

R. D.

373. Vegetative Propagation of Tea.

KEUCHENIUS, A. A. M. N. (from *Mededeelingen van het Proefstation voor Thee*, No. LXXXIV, pp. 48, figs. 28. Batavia, 1923). *Tropical Agriculturist*, Vol. L. X. II, No. 2, pp. 67-69. Peradynia, 1924.

The following is a brief abstract from an account of work done on tea-plant propagation at the Experimental Station, near Bandoeng Java. The object was to establish a method of vegetative propagation by means of which seed gardens of uniform type could be obtained.

The following methods were tested :

1. *Crown-grafting*. — The factors given below were found to exert a notable influence on the result : shade after grafting ; innate faculties of parent tree and stock ; stage of development of scion buds ; diameter and age of scion ; length of scion ; diameter and age of stock and parent tree ; climatic conditions. The average proportion of successful grafts was about 74 %.

2) *Rectangular patch-budding*. — Success was obtained in 75-85 % of the grafts.

3) *Upright stem-layering between halved section of bamboo stem*. — In one instance 210 out of 3300 layerings took root and of these 156 survived when planted out.

4) *Inarching*. — By this method the scion is kept joined to the stock for an indefinite period, hence there is little risk of failure (98 % succeeded). It is, however, tedious and expensive and therefore hardly applicable on a large scale.

5) *Veneer-grafting*. — This method is extensively used in Cinchona, but was not found to be successful for tea, as the average of successful graftings did not exceed 20 %.

6) *Shield-grafting*. — The results were about the same as in veneer-grafting.

7) *Cleft-grafting*. — The results were extremely bad, only 4 % of the graftings survived.

8) *Shield-budding*. — Worthless for tea selection.

9) *Splice-budding*. — None of the grafts survived.

10) *Layering*. — Two varieties were tried : *a*) One-year-old shoots were ringed and bent down, covered with earth fixed in position ; *b*) all stocks were cut off and in each, 3-5 vigorous shoots were kept and ringed, then the plants were earthed up 4 inches above the ringed portion.

The latter gave better results than the former.

W. S. G.

374 **Cocoa Cultivation in the British Tropical Colonies.**

DAVIES, H. S. *Journal of the Royal Society of Arts*, Vol. LXXII, No. 3714, pp. 158-168. London, 1924.

The article gives a detailed description of cocoa cultivation and discusses the tree, varieties, forming a plantation, manuring, pruning, harvesting, yield, diseases and pests, fermentation of beans, etc. The cocoa industry in the following Colonies is briefly dealt with: Trinidad, Grenada, Jamaica, Ceylon, and the Gold Coast. W. S. G.

375. **Pimento Leaf Oil Industry in Jamaica.**

Bulletin of the Imperial Institute, Vol. XXI, No. 3, p. 459-591. London, 1923.

Report of the progress made in Jamaica since the commencement of the pimento leaf oil industry in 1918. Large scale steam distillations have been made recently with the leaves of *Pimento officinalis* Lindl. The yields of oil calculated on the dried leaves varied from 0.7 to 2.4 % (average 1.6 %) and the eugenol content 41-93 %. Neither the yield of oil nor eugenol appeared to depend either on the month the leaves were collected or on the altitude at which grown.

Very satisfactory results were obtained with the steam pressure equipment (18 ft iron pipe and 40-45 lb. pressure passed from a boiler).

Reference is made to the export of oil to Great Britain and the United States. M. L. Y.

376. ***Artemisia brevifolia*, an Indian Species as a Source of Santonin.**

Bulletin of the Imperial Institute, Vol. XXI No. 2, pp. 316-318. London, 1923.

Up to the present, santonin has been derived chiefly from *Artemisia maritima*, var. *Stechmanniana*, common in Russian Turkestan. Investigations have recently been made to ascertain the possible value of the Kashmir (India) species, *A. brevifolia*, Wallich. Samples examined at the Imperial Institute, London, indicate a higher proportion of santonin in the flower buds and leaves (1.95 %) than in the stalks (1.19 %). The percentage apparently increases with development of the buds. Further investigations are considered necessary to reach definite conclusions.

M. L. Y.

377. **The Medicinal Value of *Oncoba* Oils.**

Bulletin of the Imperial Institute, Vol. XXI, No. 4, pp. 685-687. London, 1923.

Some years ago species of *Oncoba echinata* were found to contain 87.5 % chaulmoogric acid, and it appears probable that the fat of the seeds could be used for a similar purpose to *Taraktogenos Kurzii*, as a leprosy

cure (1). Recently, other species have been observed in Africa and an examination has been made of the seeds of *O. spinosa*. It was found that the constants of the oil differed considerably from those of *O. echinata*, and that no chaulmoogric acid is present. The oil is of typically drying type and might be utilised for paint and varnish, although there is a certain difficulty in separating the seeds from the pulp of the fruits.

M. L. Y.

378. **Essential Oil of *Stirlingia latifolia* from Western Australia.**

Bulletin of the Imperial Institute, Vol. XXI, No. 2, pp. 318-320. London, 1923.

It is reported that the essential oil extracted from the stems and leaves of *Stirlingia latifolia* consists almost entirely of acetophenone, of well known medicinal value. Distillation and analysis of samples received from Western Australia confirm this report. The actual yield of oil is, however, somewhat low.

M. L. Y.

Arboriculture.

379. **Avocado Culture in California.**

I. Knowles Tyerson. History, Culture, Varieties, and Marketing. *Agricultural Experiment Station, Berkeley, California, Bulletin No.* 365, pp. 574-629, figs. 19, bibliography. Berkeley, Ca., 1923.

II. Jaffa, M. E. and Goss, H. Composition and Food Value. *Idem*, pp. 630-638, tables 3. Berkeley, Ca., 1923.

I. — Rapid developments have been made in the avocado industry in California during recent years, and the author after a general survey of the history, classification, distribution, and climatic requirements of the two distinct species, *Persea americana*, Mill. and *P. drymifolia* proceeds to describe in detail the improved methods adapted to the Californian plantations.

It appears that the avocado thrives on a wide range of soil, but prefers a medium texture ; a depth of at least 4 ft. is recommended, and drainage is an essential factor. Hard layers close to the surface should be avoided. As regards orchard management, for propagation purposes, the seed of the small thin skinned Mexican race is now being used almost exclusively : the Guatemalan and West Indian root stocks have proved unsatisfactory because of their tenderness. Details of the methods of sowing, budding and grafting are given, and systems of pruning, cultural operations, irrigation, harvesting, and marketing. Reference is made to the treatment of frost injuries, and the importance of windbreaks. The damage incurred from insect pests and diseases is negligible. Investigations have been made to trace the factors affecting crop yield, hitherto not clearly understood.

(1) See *R.* 1923, No. 190. (*Ed.*)

In the New York Botanic Gardens, Dr. A. B. STOUT has made observations on the habits of the avocado flowers, and it appears that fruit setting will be more certain, if more similar varieties flowering at the same period are inter-planted, adapted to cross-pollination. The top working of two such varieties is recommended.

II. — *Nutritive value.* This investigation includes the analyses of 68 different varieties of avocado, and shows clearly the value of the easily digested protein of this fruit. The average fat content amounts to 20.6 %.

M. L. Y.

380. The Vine in Tropical Countries.

C. C. La vigne dans les régions tropicales. *Revue de Viticulture*, Year 30, Vol. LVIII, No. 1500, p. 234-236 Paris, 1923.

In most of the tropical colonies into which it has been introduced the vine has been a source of great disappointment and the results obtained by no means compensate for the trouble expended on its cultivation. This is due to the fact that with few exceptions these vines have never been grown under climatic conditions similar to those prevailing in the countries where they have long been cultivated. The vines best suited to the tropics are the following varieties : white Muscat, late Alexandrie and various kinds of Chasselas for the table. D. V. S.

381. Annual Ringing of Vines.

SANNINO, F. A. L'incisione anulare della Barbera. *Rivista di Ampelografia*, Year IV, No. 11, pp. 178-179. Alba, 1923.

The practise of ringing the vines to encourage grape production is carried out in several parts of Italy, especially at Asti. The question has been studied by F. RAVIZZA at the " Regia Stazione enologica di Asti " and by the author at the " Regia scuola di viticoltura ed enologia di Conegliano ".

It is evident that this method helps to increase the yield. If ringing is performed when the first blossoms begin to fall, premature fertilisation is encouraged, but by delaying the process until the fruit is about the size a of peppercorn, the swelling of the fruit is noticeable.

The wine from these grapes is however of poor quality. In Astigiano with the Barbera wines, in the Veneto with the Cabernet franc, and the Cabernet Sauvignon there is something lacking both in scent and flavour, and the wines cannot be conserved for long.

It may be concluded therefore that it is harmful to practise ringing after the flowering period. The decrease in sugar content may be reduced by delaying the vintage (ringing has been recommended to hasten maturity), but in such a way that no effect is noticeable as regards skin colour. In localities which produce light wines, the practise is, however, advised.

The implement used for ringing in the Asti district possesses one toothed blade which cuts round the bark without touching the other portions. Ringing is confined to the section of the stem a few inches above ground level.

F. D.

Forestry.

382. Examination of Nigerian Timbers.

Bulletin of the Imperial Institute, Vol. XXI, No. 3, pp. 444-461. London. 1923.

According to the reports on timbers furnished by the Imperial Institute Timbers Committee to the Government of Nigeria, five have been selected as of especial market value elsewhere, viz. *Terminalia superba*, *Piptadenia africana*, *Brachystegia spicaeformis*, *Afzelia africana* and *Ptero lobium* sp. Mechanical and working trials have been made and full details of the results obtained are given.

Terminalia superba (" afara ") of medium hardness and strength is recommended for manufacture of machine and hand tools ; useful also for joinery and building purposes

Piptadenia africana (" ekhimi "), strong stiff wood, moderate toughness ; good appearanc when polished or varnished ; suitable for rough construction work, doors, sills, etc.

Brachystegia spicaeformis (" okwein "), stiff and fairly hard wood of good strength ; works well for machine and handmade tools (with the exception of planes) ; should make a good substitute for mahogany in furniture and might also be useful for some kinds of building and construction work.

Afzelia africana (" alignä "), moderate toughness, and a strong wood — comparable with oak ; somewhat difficult to work but useful for furniture, solid doors, stair-ways and joinery.

Pterolobium sp. (« agba ") ; moderate hardness and strength ; fairly stiff and not brittle ; good crushing strength ; suitable for all machine and hand made tools as it has scarcely any tendency to split and is almost straight grained ; can be used also for cheap furniture, for general utility work and for local building purposes ; when stained it resembles mahogany in appearance.

Two speciment of Nigerian wood from *Chlorophora excelsa* (" iroko ") of varying weight were examined for comparison. It appears that these possessed slightly less resistance to crushing and lower modulus of rupture and elasticity than the foregoing specimens, although the shearing strengths of the latter were higher. Wood from *Chl. excelsa* has a good appearance and is suitable for joinery and other purposes.

M. L. Y.

383. The Forests of Syria.

Monnet (Inspecteur des Eaux et Forêts en mission en Syrie). Les Forêts en Syrie et au Liban. *La Géographie*, Vol. XL, No. 4, pp. 453-458. Paris, 1923.

The author gives a description both of the chief types of forest and of the different forest districts in Syria and Libya.

R. D.

384. **Reafforestation in Indo-China.**

GUIBIER, H. Inspecteur des Eaux et des Forêts, Chef du Service Général des Forêts à la Direction des Services Economiques de l'Indochine. *Bulletin Economique de l'Indochine*. Year XXVI, No. 163, pp. 449-514. Hanoi-Haiphong, 1923.

The author gives all the chief causes of the disappearance of forests in Indo-China, especially in Tonkin. The factors that have mostly contributed to the denuded state of the country are as follows: the improper working of the forests which it has hitherto been impossible to regulate (this is one of the most general causes), with the result that only part of the felled wood is removed — the fire, or "ray", method of cultivation by which the immense areas of forest destroyed far exceed the extent of land afterwards planted — burning the forest for no special object.

The result of all these practices has been, and still is (as M. AUG. CHEVALIER shows in his work entitled "Premier inventaire des bois et autres produit forestiers du Tonkin") to: further decrease the extent of the forest land; impoverish the stands by lessening the number of valuable trees; cause the gradual disappearance of the original forests full of saw-timber of first quality, and even of choice woods. These forests have been replaced by secondary forests of much inferior value where, in the long run, soft woods predominate, while in the last stage of devastation, the trees are replaced by brushwood, and in the mountainous districts, the soil being covered by nothing but gramineae, deteriorates and becomes increasingly barren.

The Forestry Service had long been concerned at a state of affairs which became worse from day to day and threatened the whole country with a lack of wood; indeed, this crisis hed already begun to make itself felt in some districts.

The first step to remedy the evil were taken with the object of substituting for, so-called, "free-felling" (which meant cutting down trees without any restrictions beyond the proviso that they should all have attained a certain diameter), regular, systematic felling in the cadaster forests that possessed clearly-defined boundaries, were regularly improved and are known as "reserves". At the same time, the Administration tried to enrich these "reserves" by propagating the good types of trees growing there, and replacing any valuable individuals that had disappeared.

Finally, already for some time, the authorities and also private individuals have been engaged in reafforestation operations on land that was formerly wooded and is believed once to have been covered with extensive forests. The "Chef du Service Forestier" of Indo-China, M. le Conservateur, ROGER DUCAMP, however, throught it opportune to warn certain adventurous spirits against a delusive optimism and rash calculations". He gives the following prudent advice: "Man must work by stages, and ask nature herself to weave again her mantel of verdure from suitable forms and with the help of the means placed at her disposal by the great laws of plant and animal biology. The intelligent action of

man must aid the efforts of nature working in harmony with her and avoiding all compulsion... In the first place, fire must be forbidden, then grazing must be stopped, while the free cutting of the merest twig, of some shrub, or fern, must be replaced by methodical felling carried out according to the laws of sylviculture. Into the green carpet thus created with the help of nature, and without any expense, it will be possible again to introduce good varieties of trees with a fair chance of success."

The article dwells at length upon these counsels which have sometimes been forgotten. It mentions numerous unsuccessful experiments of reconstituting stands by means of planting broad-leaved trees on soil of some considerable value, whereas in all cases where recourse was had to resinous species, such as the native pines, the venture had proved most satisfactory, as in the case of reafforestation work in the neighbourhood of Huê and various other parts of Annam. This work has, however, had the excellent results of protecting the ground where it has been carried out, from fire and grazing, and thanks to the respite thus afford it, the soil has improved so that first grass and then bushes have grown upon, it, thus preparing the way for the forest to reconstitute itself.

The author lays stress on the great advantage that would accrue to Tonkin from the rescue of many stands of pines that are on the point of perishing, and also states that these groups of trees should be increased, since the pine is more suited than any other tree for the reafforestation of land (especially laterite soils) which are now bare of any cultivation. The pine is also the sole tree that will naturally produce pure stands in the countries of Tonkin and Annam, whereas the forests of deciduous trees are extremely varied in their composition. This peculiarity has been dwelt upon with insistence by Prof. LECOMTE. It makes it excessively difficult, if not impossible, to create forests composed of a single variety without taking into account its particular requirements and also the nature of the soil which is here a matter of supreme importance.

In this connection, the author quotes the observations of various investigators respecting the rôle of the soil, the part played by micro-organisms, the utility of certain operations (dressing the soil, clearing the ground, irrigation, sterilising the soil by fire) ; he recalls the results obtained in India and Burma, by the work that had been done (no doubt at great expense), to maintain and reconstruct the valuable existing stands, and even to form new ones.

It must not, however, be supposed that a forest can be easily created, even by as large outlay, in regions where it would appear that natural forests have never existed. It would be a most unprofitable investment for private individuals to lay out large sums for years on such an undertaking with no hope of any returns being available for half a century or more. Therefore, it is the duty of the Administration to point out the difficulties and the risks to be encountered, but it should on its side carry out all the tests necessary to decided what is practically possible.

It would be better to devote the money destined to an enterprise of such doubtful success to the improvement of the means of access to

forests hitherto difficult to approach and unworked, or to bettering the means of exploitation, clearing and transport, in one word, to making the best use of the existing forests of which a very considerable portion still remains untouched and is depreciating in value without profiting anyone.

There is still a good deal of land in Tonkin, Annam, and elsewhere, which is unsuited to cultivation, but where a forest of special trees would flourish. Afforestation operations should thus first be conducted in this land, care being taken in each case to select the right variety of tree, viz., pines for all laterite soils (these have so far succeeded invariably); *Casuarina* spp. which has thriven beyond all expectation on the sands bordering the sea-coast and which cover many thousand hectares in North Annam, while in South Annam, it has fixed the moving sands and thus freed the crops from the constant danger of being overwhelmed. In the latter country, there are sufficient pines to form forests vast enough to prevent any future timber crisis. It would be well to study more thoroughly certain particular trees which are able to live in pure groups (if they cannot form unmixed stands), in forests of broad-leaved species, and are useful for special purposes (supplying wood for matches, for instance). At the same time, the best trees for saw-timber must be studied with a view to their propagation in forests where they are likely to do well.

The author insists upon the utility of nurseries, and reproduces copies of the information obtained during two years at a forestry Station in Central Annam by carefully registering the observations made every day.

Such observations, if collected for several years, and compared with similar data furnished from other districts, would enable accurate ideas to be formed. The author supports his advice by quoting one of the resolutions passed in 1923 at the Second Scientific Congress of the Pacific. "The only sure method is to make small nurseries in climatic zones where the conditions resemble as closely as possible those prevailing in the districts where plantations are required."

He concludes by laying stress on the utility of scientific studies dealing with sylviculture without which even a junior forestry agent cannot carry out his task satisfactorily.

The paper is illustrated with many photographic reproductions of nurseries, plantations etc. It is a pamphlet for the instruction of foresters, having been written for the purpose of placing useful information within the reach of all, which would be difficult for subordinate forestry officials unused to reading scientific works, to extract from the mass of data usually supplied to them. H. G.

355. Report of the Forest Inspection in Laos, Indo-China.

NIQUET, L. *Bulletin économique de l'Indo-chine*. Year XXV, No. 153, pp. 101-130, plates 3 and Year XXVI, pp. 413-426, plates 2. Hanoi Haiphong, 1922 and 1923.

An inspection was organised by the author with the object of studying the forest possibilities in the different regions of Indo-China.

The area included was as follows :

1st tour : Saigon, Vientiane, Paklay, Luang-prabang. Banhouei-sai, l'Honei-hen (Burmese frontier), Luang-prabang, Centiane, Paksane, Borikhan, Xieng-Khouang. Paksane, Thakhek, Nakai, Napé, Cam-kent, Pak-hin-boun, Thakbek, Savanna-khet, Wapi, Khône, Saigon.

2nd. tour : Hanoi, Vinh, Cua-Rao, Nong-Het, Xieng-Khouang, Muong-Suoi, Xieng-Khouang, Tha-Thom, Paksane, Savannaket, Ya-Peut, Saravane. Tha-Theng-Paksong, Phone-Thani, Attopen, Fia-Fay, Khong, Se-Lampao, Khong, Hat-Nhyao, Siempang, Stung-Preng, Phnom-Penh.

Observations were made :—

1) on the teak forests of Haut-Mekong, with special note of the Siammese teak forests in the basins of Me-Ing and Makok ;

2) on other species in Haut-Mekong (Lao);

3) on the resin species on the plains, Tranninh ;

4) on the woods of the Nam-Sane valley (Ventiane);

5) on the resin species of the Nakai plateau (Prov. Cammon);

6) on the forests of Bas-Laos. (Provinces-Saravane Attopen, Haute-Sékong, and the Kuong and Sé-Lampao districts).

Special attention is given to the teak forests. A description is made of the general characteristics, followed by a brief survey of the peculiarities of the teak of Haut-Mekong and the neighbouring districts of Siain. A comparison is made between the teaks of Haut-Laos and those in areas where this species is most abundant, with notes on the distribution.

Observations were also made on the pine forests of Tranninh, and the value which should be attached to the wide areas covered with these trees on the plateaux. The author gives a detailed description of the qualities of resin obtained, extraction and distillation and points out the possibilities of exploitation.

A brief reference is made to other regions visited by the author.

Bas Laos in the province of Saravan was considered of special interest, and in this case a full description is given of the forest area and a general plan of the different species found. R. D.

386. **British Honduras Timbers.**

Summary of Reports made by the Director of the Imperial Institute. *Bulletin of the Imperial Institute*, Vol. XXI, No. 4, pp. 569-581. London, 1923.

Of the numerous timbers found in British Honduras only two, mahogany, and cedar, are exported in quantity apart from logwood which is used only as a dye.

In order to ascertain the value of other timbers, logs of several other kinds were sent to the Imperial Institute, the investigations of four of which have been completed. The local names of these four timbers are " Banak ". " Santa Maria ", " Sam Wood " and " Black Poisonwood ". The botanical identity of these trees is not known with certainty.

Banak appears to be a species of *Myristica ;* Santa Maria is probably

a species of *Calophyllum*; Sam Wood is sometimes stated to be a species of Jacaranda; Black Poisonwood belongs to the N. O. *Anacardiaceae* and may be a species of *Mauria*.

Banak Wood. This wood is fairly light, 31.9 lb per cubic foot pinkish-yellow in colour, darkening on exposure; moderate in strength, fairly soft and easily worked, does not warp, free from knots. Useful for general construction, but shows black lines probably due to fungus, which would be detrimental.

Santa Maria. The wood was almost free from knots but warped badly; grain fairly short-fibred and very wavy; colour pinkish-brown; polishes satisfactorily and stains well. Weight, 36.3 lb per cubic foot; has good crushing strength, resistant to shearing. The wood is of good appearance but somewhat "woolly" in working up; in the market it would probably rank just above Gaboon Mahogany.

Sam Wood. In radial section the wood was pinkish-yellow and lustrous: the planks were free from knots and fungoid growth. Weight, 37.7 lb per cubic foot. There was little tendency to warp, the grain is very straight fairly high elasticity but showed great variation in density. Considered to be suitable for general construction work and perhaps for furniture.

Black Poisonwood. Planks cut from the log were badly cracked; there was no indication of fungoid growth, and the timber was practically free from knots. The wood is heavy, 63 lb per cubic foot, hard, fairly long-fibred, of good strength and elasticity.

In transverse section the sapwood was light yellow-brown, and reddish-brown with black stripes in radial section. The wood is hard and difficult to work, but is regarded as suitable for decorative purposes, countertops and heavy furniture. **W. S. G.**

387. Forest Resources of Chile.

Journal of Royal Society of Arts, Vol. LXXII, No. 3714, pp. 169-170. London, 1924.

According to the annual report by H. M. Consul-General at Valparaiso, the Southern zone is practically covered with forests, the most important being found from latitude 37° to 44°. The area covered is estimated at 75 000 sq. miles.

Amongst the classes of timber exploited are the following:

Rauli (*Nothofagus procera*). The wood is red, veined, medium weight, almost free from knots. Used for building, furniture, and barrel making.

Roble Pellin (*Nothofagus obliqua*); Chilian red oak, matures slowly, used for beams, building barges and railway sleepers.

Alerce (*Fitzroya patagonica*); thrives in swampy districts; grows to a height of 60 ft. by 5 ft. diameter. The wood is used for roofing, it is not affected by moisture.

Coeine (*Nothofagus Dombeyi*), used for sleepers.

Cypress de Cordillera (*Libocedrus chilensis*); light in weight, pale yellow, used for furniture.

Lingue (*Persea Lingue*), has a rich coloured vein, can be made to imitate various classes of fine wood.

Laurel (*Laurelia aromatica* and *Laurelia serrata*), used for floorings and ceilings, parquet and furniture.

Litre (*Lithraea caustica*), used for cart wheels.

Manui (*Podocarpus oleifolia* = *P. chilena*), durable, aromatic, yellow. Used for flooring, masts and spars.

Quillay (*Quillaja Saponaria*), trunk and branches used for firewood and charcoal ; the bark for chemical purposes.

Algarrobilla (*Caesalpinia brevifolia*), a shrub, chiefly valuable for the berry which is used for tanning, mostly exported.

Various agricultural societies are interested in re-planting areas, principally with eucalyptus and cypress.

Transportation is the chief difficulty owing to the lack of roads, and rivers capable of rafting lumber to the coast. The Chilian forests open an important field for the manufacture of wood-pulp. W. S. G.

388. **A Device to Facilitate Tree-Planting.**

South African Journal of Industries, Vol. VII, No. 2, p. 110. Pretoria, 1924.

Among recent inventions is one by I. A. GRANT of Duivels Kloof, Transvaal, to facilitate tree-planting. It is known as the " Duivel " tree-planter ; the principle on which it works is that of taking up the nursery soil around the young tree, with the tree in the centre, and planting the whole in the position where the tree is to remain permanently, without disturbing the roots. This is carried out by means of a metal cylinder which is placed round the tree and pushed down into the soil. The cylinder, together with the contained soil and the young tree, is then withdrawn and planted in its new position, after which the cylinder is withdrawn.

It is claimed that a young tree can be planted out with the " Duivel " planter in the hottest sun without injury, and without watering at the time of planting. W. S. G.

LIVE STOCK AND BREEDING.

389. **The Woolly-Pod Milkweed *(Asclepias eriocarpa)* as a Poisonous Plant.**

DWIGHT MARSH, C. and CLAWSON, A. B. *United States Department of Agriculture, Bulletin* No. 1212, pp. 1-13. tables 4, figs. 5. Washington, D. C., 1924.

A somewhat general statement has been made by stock breeders as to the poisonous properties of milk weeds (*Asclepias* spp.), but the fact that certain species are more virulent than others has been given insufficient attention. The authors have carried out a series of experiments and have identified the nature of poisoning of sheep attribut-

(1) See *R.* 923, No 735. (*Ed.*)

ed to *Asclepias eriocarpa* which has frequently been confused with the species *A. fremontii*.

After giving a description of the plant and special characteristics, a typical case of sheep poisoning is taken and full details given of symptoms of poisoning viz. depression, rapid and weak pulse, lowered temperature. These symptoms appeared several hours after administration of the plant. In some cases results have been fatal, and in any case recovery was slow and gradual.

This plant has been shown to be very poisonous not only to sheep but also to cattle although animals are not likely to eat it except when other forage is scarce, it is dangerous because of its especially toxic character seeing that as little as 0.1 lb. per cwt. of animal may poison and 0.22 lb. may cause death. The stems and leaves are equally toxic.

M. L. Y.

390. Iron Content of Blood and Spleen in Infectious Equine Anaemia.

WRIGHT, LEWIS. R. (Nevada Agricultural Experiment Station). *Journal of Agricultural Research*. Vol. XXVI, No. 5, pp. 230-242, tables 2. Washington, 1923.

The author has made a study of the iron content of blood and spleen in animals suffering from infectious equine anaemia. In this connection, there were two problems to be solved: 1) The reason of the want of haemoglobin. The examination of the blood of infected individuals often revealed the presence of a large number of red corpuscles with a low percentage of haemoglobin, as well as of some dark corpuscles found in the fat which suggests a greater lack of haemoglobin than would be supposed from the number of red corpuscles. 2) The ultimate fate of the corpuscles after their destruction, since anaemia is attributed to the destruction of the red corpuscles. It is exceptional for any loss of blood, or of haemoglobin, to be clearly noticeable in any of the secretions of the body (urine or faeces), or for the examination of the urine to afford evident proof of an increase elimination of the iron pigment. As the spleen is the known seat of the destruction of the erythrocytes, it was suggested that it was possible that an unusual destruction of the red corpuscles took place in this organ, while the iron was retained. The liver and spleen proved on investigation to contain a large amount of iron pigment, probably haemosiderine. An attempt was then made to study the elimination of the iron which was regarded as being one of the most important factors causing anaemia. The blood used for the purpose was taken from the jugular vein and immediately weighed to avoid all loss due to evaporation.

A portion of the spleen was removed during the post mortem examination, made at once after the death of the animal. The iron content was estimated from an air-dried sample, the loss by drying being noted and the iron found calculated as ferric oxide (Fe_2O_3). Another estimation was made from the blood (Neumann's iodometric method being employed), after the destruction of the organic matter in aqua regia. The corpuscles were counted in the usual way, a sample of blood being taken from the lower surface of the tail.

The haemoglobin was estimated by the Talguist method. It is interesting to observe the enormous increase of the iron content of the spleen in old horses. The percentage of iron in the spleen is much increased in young horses suffering from acute infectious anaemia. This does not occur in the case of old animals, or of individuals suffering from chronic anaemia, in which the spleen contains less iron than in normal cases. The weight of the spleen is increased nearly five-fold in young horses suffering from acute anaemia. The spleen increases greatly in volume in old infected horses, but the iron content is only slightly more than in the case of healthy animals. As a rule, anaemic symptoms are much more pronounced in chronic than in acute cases. It has also been found that the total of solid substances (iron, haemoglobin and erythrocytes), is higher in healthy individuals. The increase in the iron content of the spleen in young horses cannot be exclusively due to the larger amount of blood present in that organ since the iron introduced by the additional quantity of blood is not sufficient to explain the total increase observed. P. D.

391. **Milk and Contagious Abortion in Cattle.**

PANISSET, L. (Professeur à l'école vétérinaire d'Alfort). Le lait et l'avortement épizootique des bovidés. Virulence et nocuité du lait. *Le Lait*, Year 4, Vol. IV, No. 32, pp. 124-133. Lyons, 1924.

Epizootic abortion in cattle is a localised contagious disease due to the presence of large numbers of a specific micro-organism, the *Bacillus abortus* of BANG. The agent of the disease and the troubles it causes are almost entirely confined to the genital organs and their contents during gestation.

The anatomical connections and the physical relations existing between the reproductive system and the udder have suggested that the development of contagious abortion may have some effect upon milk secretion. Intraperitoneal inoculations made in guinea-pigs during the researches conducted for the purpose of discovering the tuberculosis bacillus in commercial milk revealed the presence of special lesions differing from those caused by the bacilli of tuberculosis and not containing any of these micro-organisms which are easily recognised by their number and acid-resistance.

Similar results were obtained from milk taken with every precaution to avoid infection from any other source than the inside of the udder. It was only through the use of a special culture medium, ox-gall, that SCHROEDER and COTTON succeeded in cultivating and identifying the agent producing these lesions. *Bacillus abortus*, the agent of contagious abortion in cows, is present in apparently healthy animals. Out of 277 milk samples examined, 30 were found by inoculation to contain the abortion bacillus. During their search for the bacillus in the milk of cows belonging to the same herd, SCHROEDER and COTTON found 19 out of 140 samples to be virulent ; on another farm, 11 out of 36 cows produced milk containing the pathological agent, which, according to EVANS, occurs in 23% of the milk examined. A very interesting fact is the vary-

ing persistence with which the bacillus is found in the milk, the latter may be continually, or intermittently infected, and may remain virulent only for a very short time, or for years. Cows evacuating the bacilli in their milk are healthy to all appearance, but their infected condition can be detected as blood serum has the property of agglutinating the agent of the disease. The serum has no agglutinating effect if there are no bacilli in the milk ; infected milk also has an agglutinating property. The milk is, however, not by any means always virulent, even when the serum test gives positive results and the milk itself is agglutinant. The bacillus of abortion lives in the udder which is indeed its favourite abode except during the gestation period, as has been proved by experiment.

A goat subjected to intervenous inoculation evacuated these bacilli in its milk 24 hours after the operation ; the bacilli continued to pass into the milk for a period of 2 months. Another goat having received a subcutaneous injection was only infectious from the second to the sixth day after the inoculation. Milk has very great power of agglutinating *Bacillus abortus* the rate of agglutination being 1 in 25. The degree of agglutination varies for the same cow with the quarter from which the milk is taken, the time of milking, the amount of milk secretion and the lactation period. There is no connection between the degree of the agglutination of the milk and the agglutination property of the serum ; when the results given by the milk are positive, the serum also gives positive results.

Sometimes the agglutinating power of one quarter is much higher than that of the others, or of the serum. The hind quarters are most commonly attacked. The agglutinating power of the milk may quickly follow the infection of the udder (24 hours after injection) and the agglutinating power of the infected quarter is distinctly higher than that of the other quarters. Colostrum possesses greater agglutinating properties than serum and is therefore able to produce agglutinating properties that are lacking in a calf even if the latter is the offspring of a diseased dam and has developed in an infected envelope. One hour after the calf has taken the colostrum, its blood becomes agglutinant : cows can be infected through the udder ; dirty external surroundings, the countless means of contamination at milking-time, want of clean hands in the milker all may contribute in making the teat a source of propagation of the disease.

As a matter of fact, however, infection by way of the teat is limited and of secondary importance, the favourite path of the bacillus being the digestive canal. Many researches have been made (especially since the establishment of absolute identity of *Bacillus abortus* of cattle and *Micrococcus melitensis* the agent of Mediterranean fever in man), to discover whether milk coming from cows suffering from contagious abortion is harmful to human beings. The direct inoculation of *Bacillus abortus* has never produced fever or any disturbance in human subjects ; the blood cultures remained sterile and, as a rule, no agglutination took place. Therefore since it is well-known how readily man is infected by *Micrococcus melitensis* we may safely conclude that *Bacillus abortus* is not an agent producing disease in the human race. P. D.

392. **Piroplasmosis, Scab and Anthrax in North Africa.**

I. — SERGENT, EDM., PARROT, L. and HILBERT, D. N. La Piroplasmose du mouton en Algérie, étude de *Piroplasma* (gonderia) *ovis* : *Archives des Instituts Pasteur de l'Afrique du Nord*, Vol. III, No. 3, pp. 127-135. Algiers, 1923.

II. — BRIDRÉ, J. and BOCQUET, A. La vaccination anticlaveleuse par virus sensibilisé après 10 ans d'application. *Ibidem*, pp. 172-176. Algiers, 1923.

III. — ROSSI, P. (Vétérinaire du Service d'Elevage). Vaccination et Sérothérapie contre la fièvre charbonneuse dans la circonscription de Bouira (Algeria), pp. 177-178. Algiers, 1923.

IV. — BÉGUET, U. Du rôle des animaux mangeurs de cadavres dans la propagation de la fièvre charbonneuse, en Algérie. *Ibidem*, pp. 124-126. Algiers, 1923.

I. — The existence of piroplasmosis in Algeria has been proved by the authors, who discovered piroplasms in the blood of sheep that had died of epizootic disease. The presence of the disease is shown by loss of appetite and fatigue ; on the second day, haemoglobinuria and breathlessness set in, death usually supervening at the end of 4 or 6 days. The authors describe at length the morphological and anatomical characters of the disease, as well as the process by which the parasites of the red blood-corpuscles multiply.

It is interesting to note that pure-bred European sheep running with a flock of native animals contracted piroplasmosis, as did also about a quarter of their hybrid progeny, whereas the Algerian sheep with which they mixed showed no symptoms of disease or traces of parasites in the blood. The authors conclude that the piroplasma virus is tolerated by the native sheep which act as disease carriers thus infecting the better-bred animals introduced into the flock. Under certain circumstances, however, *Piroplasma ovis* may become pathogenetic, even for the native sheep.

II. — The authors show that the practice of antiscab vaccination is rapidly eliminating the centres of the disease, immunity being conferred 48 hours after the injection of the vaccine and lasting for at least one year. It is worthy of note that secondary scab lesions have never been found in vaccinated sheep and that no case has been reported of the infection of healthy flocks by means of vaccinated sheep. Since it is quite innocuous, anti-scab vaccination can be practised in the absence of the disease, should circumstances render it desirable ; its action is certain and rapid and it is the sole preventive of the disease, but has no influence on the course of the disease when once it has been contracted. The authors have found that an epizootic outbreak can be checked within 15 days by vaccination. Sero-vaccination is not employed in this case, as it is too difficult to determine the proper time for its application. Great service can, however, be rendered from the remedial standpoint by serotherapy for if adopted as soon as the lesions appear, the development of benign scab is arrested and the severity of

malignant scab is reduced. It has been proved that vaccination is possible no matter what the age or physiological condition of the sheep may be. Further, it occasions no disturbances in gestation, or in suckling the lambs, the utmost it may do is slightly to reduce the milk secretion during the feverish period of the general reaction that follows vaccination. The latter can be carried out at any season and the same amount of vaccine is used for all sheep without exception.

Vaccination during the gestation period has frequently been found to confer immunity both on dam and offspring. In short, the best method to adopt as regards a scabby flock (in addition to carrying out the sanitary measures required by laws, is as follows : 1) Separate and isolate the infected animals for some days, in order to protect from scab those individuals that are about to be vaccinated, since immunity is only secured two days after vaccination ; 2) Vaccinate all sheep that, although apparently sound have been exposed to infection 3) Watch the flock carefully, and if the disease breaks out in a severe form, to treat all the infected animals with antiscab serum, in order if possible, to reduce to a minimum the gravity and duration of the epizootic outbreak.

III. — The author has tried to use new vaccines for the control of anthrax, a disease of frequent occurrence in Algeria. The reactions have as a rule been violent. In the case of cattle, the breed, sex, work, age and general condition of the individual have no influence on the reaction. Vaccination does not affect gestation or calving, but the milk secretion is decreased. The percentage of the reactions increases gradually with age. Horses are still more susceptible to these vaccines ; the age of the animals seems to have little influence and the reactions are the same in native and European horses. Preventive serotherapy must be practised early in order to give favourable results. Temperature and blood pressure offer the surest indications of the probable results of injecting the serum. P. D.

393. **Intestinal Round Worms of Scottish Sheep.**

CAMERON, E. W. M. (Ministry of Agriculture, Research Scholar. London School of Tropical Medecine. *The Scottish Journal of Agriculture*, Volume VII, No. 1, pp. 86-88. Edinburgh, 1924.

Scottish sheep frequently harbour, in addition to hook-worms and stomach-worms, numerous little intestinal parasites belonging for the most part to the family Trichostrongylides. The most important of these worms are members of the genus *Nematodirus ;* two species, *N. Filicollis* and *N. Spathiger*, which present differences only distinguishable under the microscope, are met with in Scotland. The parasites sometimes occur in very large numbers in the small intestine of sheep where they assume a round shape much resembling a ball of wool or hair. In their natural condition, these worms are of a pinkish colour which proves them to be blood-suckers, although they are never found adhering to the walls of the intestine, even when the post-mortem examination has been carried out immediately after the death of the host. The author describes the male and female forms and also the development of the larvae which

being ejected with the faeces contaminate the grass and are eaten (when in adult form) by grazing sheep. The presence of large numbers of such parasites causes physiological poverty and serious waste of nutritive substances. No satisfactory treatment for these pests has yet been discovered, although the preventive remedies used in the case of stomach-worms can also be applied against these intestinal parasites. The latter attack goats as well as sheep. Other small parasites worms are also found in Scottish sheep, *Cooperia curticei* being especially common, but they do not appear to be of any economic importance. A little round worm, *Trichuris ovis*, is, however, more dangerous, for it frequently invades the muscular wall of the coecum causing a restricted zone of inflammation round the perforation and thus opening the way to bacterial infection. Little is known respecting the life-cycle of *Trichuris ovis*, but it is probably direct, the eggs evacuated with the excreta producing an embryo, which on being swallowed by a sheep completes its development in the body of that animal. No effective treatment is known, for owing to the position of the parasite in the intestinal wall, all the usual drugs have proved to be without effect. P. D.

394. **Sexual Hormones and their Specific Action upon the Organism.**

Cosmao G. (Directeur des études à l'Institut National Agronomique). L'inversion expérimentale du sexe chez les oiseaux. *La Revue de Zootechnie, la Rrevue des éleveurs*, Year 3, No. 3, pp. 194-199. Paris, 1924.

Among the internal secretory glands known as vascular, or endocrinic, are classed the sexual glands which by pouring their products of secretion into the blood exert a distinct influence on certain sexual characters. In this connection, the author mentions the researches conducted by M. Pézard, Director of the work of the Laboratory of General Biology at the *École des Hautes Études*. The subjects selected for these experiments were Gallinaceae, since in these birds, sexual dimorphism is very clearly marked. These dimorphic characters are known as secondary sexual characters. The first question studied was whether these secondary sexual characters are an integral part of the bird or depend on the presence of the sexual gland and are affected by chemical product of this gland. A buff Leghorn cockerel was castrated at the age of 4 months ; this bird developed no comb, or wattles, and was free from combative instinct ; it did not crow, although its plumage and spurs appeared normal. On the other hand, a hen that had been subjected to ovariotomy developed spurs, while its plumage changed shortly afterwards to such an extent that the bird looked exactly like a cock with a small comb. The development and turgescence of the comb and wattles, the power of crowing and the combative instinct are therefore all characters depending on the internal secretion of the testicles ; the plumage and spurs are not properly speaking male characters since they are latent in the female and are only prevented from making their appearance by the inhibitory action of the ovary. It was thus demonstrated that secondary sexual characters are dependent positively, or negatively, upon the reproductive glands. It, however, still remained to

find out whether this physiological correlation was established by way of the nerves or the endocrine glands.

Some pieces of testicle were grafted into the peritoneum of a capon with the result that its comb began to grow again and the combative instinct returned. A fragment of ovary was grafted on a hen from which the ovary had been removed and forthwith the spurs stopped growing. Since the characters lost by de-sexed birds re-appear immediately as a result of the grafting of portions of sexual glands, even in places far from the position assigned to them by nature, it is certain that the correlation between these sexual characters and the glands is established along an endocrinal, humoral path and not by way of the nerves.

These transplantation experiments have shown the impossibility of obtaining stable intermediate forms between the neuter and the normal sexual form (M. PÉZARD's law of "all or nothing"). It was also proved that there exists an "effective minimum" of the amount of the sexual gland to be transplanted in order to renew the characters lost by castration; above this minimum the renewal takes place with the same intensity and rapidity no matter how much of the gland is transplanted ("law of functional constancy"). The last point to be explained was the "equipotentiality" viz., the power of evolution in the direction of the male form as well as in that of the female form; it is now possible to make the cock, or the hen develop in the direction opposite to that of its original sexuality. A Leghorn cock castrated at the age of 1 ½ years assumed, after a small piece of ovary had been grafted on it, all the external characters of a Leghorn hen. This explains many anomalies which have hitherto remained most mysterious. Further, cases of bi-partite gynandromorphism, far from being an argument against the theory of sexual hormones, are a striking confirmation of its truth, as is proved by the recent researches of M. PÉZARD. The theory of sexual hormones may be summarised as follows: 1) A correlation exists between the sexual glands and the development of sexual characters; 2) this correlation is effected by humoral mechanism along an endocrinic route, and not by way of the nerves; 3) the same potentiality exists in both the male and the female. P. D.

395. Cakes, Bone-Meal and Fish-Meal.

I. — VOITELLIER. Rôle des tourteaux dans l'alimentation du bétail. Méthode nouvelle pour l'estimation du prix de revient des matières albuminoïdes. *Revue de Zootechnie, la Revue des Éleveurs*. Year 3, No. 1, pp. 38-42. Tables 3. Paris, 1924.

II. — HOC, P. — Les tourteaux, facteurs nécessaires de la production laitière. *Journal d'Agriculture pratique*, Year 87, Part. II, Nos. 50 and 51, pp. 475-477, 520-501. Paris, 1923.

III. — POULAIN, A. Les aliments complémentaires du porc. *La Vie Agricole et Rurale*, Year 13, Vol. XXIV, No. 1, pp. 12-13. Paris, 1924.

I) — The continually increasing price of cakes has caused anxiety to various agricultural associations lest this stock feed should be replaced

by bread-making cereals. This fear is, however, founded on an erroneous idea of the part played by cakes in the rations of animals. If the rôle of cake in cattle feeding in examined, it will be seen that in the majority of cases they serve to maintain the equilibrium of the daily ration, that is to say, they insure the best nutritive relation between the nitrogenous matters on the one hand, and the fats and carbohydrates on the other, thus the rations are utilised to the fullest extent. The author is therefore of opinion that as long as the different cakes supply a kg. of nitrogenous matter at a lower cost than that of the cereals harvested on the farm, they should certainly be used as a stock-feed. The ordinary method of estimating this cost is first to find the net cost of the nutritive unit and then to calculate the price per kg. of the albuminoid substances in the cakes and cereals. All transport, storage, cleaning or delivery costs must be included. For example, the net cost of the food unit in the case of good meadow hay containing 31 food units per cent. and costing at the farm 22 francs per 100 kg. would be 0.78 fr. and as it contains 3.8 % of albuminoid substances, the net cost per kg. of albuminoid matter would amount to 5.78 fr. The author shows that this method has the defect of not closely connecting the two problems, viz., the net price of the food unit and the net price per kg. of the albuminoid substances. Since the object of buying cakes is to narrow the nutritive relation, it is the excess nitrogenous matter in the cakes that is paid for at a higher price. Thus, in the opinion of the author, it is necessary in order to get a true estimate, to charge the digestive principles contained in 100 kg. of the foods compared at the rate they would cost when supplied by good meadow hay. The figures thus obtained must be deducted from the price per 100 kg. on the farm, the remainder being divided by the difference between the albuminoid matter content of the hay and of the food in question. In this way, the excess amount of the albuminoids as compared with those in the meadow hay will be obtained. Good meadow hay, price 22 fr. per 100 kg. contains 31 nutritive units (n. u.), this the unit costs 0.76 fr. Coconut cake contains 76.5 (n. u.), so its hay value would be $76.5 \times 0.76 = 55.8$. Its price on the market is 76 fr. ; hence we have a difference of $76 - 55.84 = 20.16$. The difference in the albuminoid content of coconut cake and hay is 12.5 units, which makes the price paid for the larger percentage of albuminoid substances in coconut cake as compared with good hay amount to $20.16 : 12.5 = 1.61$. It is clear that the method proposed by the author gives a more exact idea of the relative values of concentrated foods from the moment when their use affects the balance of the rations. The manurial value of the concentrated food used must also be taken into account.

II. — The maximum profit from dairy cows can only be obtained by keeping breeds that are thoroughly adapted to their surroundings, while the animals must be carefully selected, well-cared for and properly fed. The systematic feeding of dairy cows includes feeding special rations that are able to supply during the lactation period the largest amount of nitrogenous matter. A cow weighing 500 kg. and giving 10 litres of milk should receive 1000 to 1200 gm. protein a day.

It must, however, be observed that the foods grown on the farm are physiologically incapable of supplying a dairy cow with the amount of nitrogenous matter it requires. Cakes are the only supplementary concentrates that can economically make up the deficiency of the nitrogenous substanes present in the other elements of the ration. The author after the experiments of MM. BAILLY, and BENOIST of the Department of Agriculture of Eure and Loire has taken pains to prove that, even at the present prices, a good return can be obtained from cakes owing to the large yield produced by their use. Flemish cows of the average weight of 500 kg. were employed in the experiment. The ordinary ration was: straw 8 kg., mangels 36 kg., wheat chaff 4 kg., groundnut cake 1.800 kg. or 1300 gm. digestible protein. The average milk yield attained 7 litres per head and per day. The cows were divided into 2 lots comparable as regards weight, milk yield and date of calving. Lot I wheat straw 8 kg.; chaff 7 kg., mangels 63 kg. Before the experiment, the milk yield of the lot was 29.800 litres; the weight of the cows being 1580 kg. After the first week, the milk yield fell to an average of 24.100 litres, at which it remained throughout the experiment, thus the daily decrease was 5.100 litres. The weight of the animals increased 36 kg. at first, but this was due to the hydration of the tissues caused by the large water content of some of the elements of the ration. The author made a calculation proving clearly that the omission of the cakes (1.800 kg. per day) was shown at the end by a daily loss of 0.65 kg. per head. The experiment was then reversed, the ration being: straw 8 kg., chaff 4 kg.; mangels 36 kg., groundnut cake 2.800 kg. Owing to the distant date of calving, the milk yield was not at all affected, but the weight rose from 1609 kg. to 1688 kg. which gave, as the profit from feeding on groundnut cake, the sum of 97.04 fr. Lot II were fed the same ration as before and an increase in both milk and weigh was observable. Later, the cake was left out and the ration was as follows: Straw 8 kg., mangels 63 kg., chaff 7 kg. From the first week, a fall in milk yield and weight set in which continued increasing. The author proved that the omission of the cake caused a loss of milk and weight amounting to 90 fr. per head and per month. In Lot III, the cows received a ration containing a large amount of cake, 2.800 kg. The lactation was not at all affected, but the weight rose 63 kg. A profit of 146.70 fr per lot was estimated. The examination of the results obtained from Lot III, shows that there is an optimum limit in the use of cakes. The plus-value of the manure which the author estimates at 10 fr. per head and per month was not taken into account.

In another experiment, 25 cows were employed The milk obtained was measured during one week; the following week, the animals were fed a supplementary ration of 1 kg. of cake per head and per day with the result that the milk yield was increased 473 litres, giving a monetary profit of 8.55 fr. We may thus conclude with the author that the introduction of cake into the ration immediately proves profitable and that the partial, or total, suppression of cake is always shown by a decrease of gain.

III. — Sesame cake contains 35 % of albuminoids 2.5, to 3 % phosphoric acid and 2.5 % of lime. A feeding experiment was carried out with swine. One sow weighing 100 kg. and in farrow was given : palm-oil cake 1.100 kg., sharps 1.100 kg. and sesame 0.200 kg., while a nursing sow received shorts 1.100 kg., maize, barley, or flour 1 kg., palm oil cake 1.300, sesame 1.300. It has been noticed that the substitution of the same amount of sesame in place of the groundnut cake in the ration of nursing sows had the effect of eliminating the attacks of diarrhoea from which sucking-pigs suffer. Sesame together with fish-meal reduced the loss of weight of the nursing-sows during the suckling period. A ration composed of : sharps and maize 2 kg., palm-oil 1 kg., fish-meal 0.300 kg., sesame 0.300 kg. maintained a nursing-sow with 8 piglings in perfet health, the weight of the whole litter when 69 days old being 164 kg. It must be remembered that sesame-cake is slightly constipating. Fish-meal is very rich in albuminous substances (58-60 %), phosphoric acid (7.6 %) and salt (3-4 %). One experiment conducted on growing pigs, would seem to prove that fish-meal introduced at the rate of 16 % increases the digestive returns 25 %. Experiments on breeding-animals show that the addition of 300 gm. of fish-meal produces : 1) an increase in the weight of the pigling at birth of 100 gm. and over ; 2) a reduction in the loss of weight of the nursing-sow of 30 to 40 % ; 3) sucking-pigs with better health and increasing 1 to 2 kg. in weight in 60 days. The addition of bone-meal to pigs' rations has proved very beneficial in the case of growing animals, the rapidity of their growth being increased and the net cost of the pork being decreased ; 90 gm. of bone-meal added to the daily rations of young pigs weighing 35 to 50 kg. produced an increase of 1.200 kg. in live-weight per head and per fortnight, as well as saving 10 % of the amount of food required to produce 1 kg. of meat. An experiment was conducted with breeding-animals, one sow in farrow being fed : 1.100 kg. palm-oil, and 1.100 kg. sharps, while another of breeding age and weighing 100 kg. received 1.500 kg. of palm-oil, and 1.500 kg. sharps. An increase of 50 to 100 gm., according to the size of the litter, was obtained in the weight of the piglings at birth by the addition of 100 gm. bone-meal to each of the rations ; it also had the effect of : 1) causing the young pigs to grow faster (they weighed on an average 1 kg. more when weaned than others) ; 2) reducing the loss of weight in the nursing-sow from 16 to 20 %. P. D.

396. **The Physiological Eflect of Gossypol.**

MÉNAUL, PAUL (Department of Chemistry, Oklahoma Agricultural Experiment station). *Journal of Agricultural Research*, Vol. XXVI, No. 5, pp. 233-237, tables 5. Washington, 1923.

The high food value of cotton-seed and cotton-seed meal has led to many researches being made with the object of determining the nature of the toxic substance contained in these products. WITHERS and CARRUTH have shown the poisonous property to be due to a phenolised compound called " gossypol ".

Experiments have been made to find out the effect exercised by this toxin on various kinds of animals. The gossypol used for the purpose was prepared by crystallisation by acetic acid and then dissolved in N/10 caustic, soda. the excess alkali being neutralised by the addition of an acid until a neutral litmus-paper reaction was obtained. No toxic effect was produced in a rabbit weighing 4 lb. by giving it ½ gm. of gossypol. The same amount injected into the peritoneum induced no pathological symptons for 36 hours, but the animal refused all food, and death supervened after 4 days. The injection of $^{1}/_{10}$ gm. into the marginal vein of a rabbit caused symptoms of suffocation, followed at the end of 4 minutes, by death. The injection of $^{5}/_{100}$ gm. in the same manner caused absolute immobility after 10 minutes ; after one hour, power of movement returned, but the rabbit died at the end of 16 hours owing to haemoglobinuria having set in. A ration entailing the daily ingestion of 0.1 gm. of gossypol produces intestinal inflammation followed, at the end of 14 days, by death. The spectroscopic examination of a dilution of ½ cc. of blood corpuscles in 75 cc. of water revealed two clear and distinct absorption bands near ray " D ". No change was effected by the addition to the solution of $^{1}/_{100}$, $^{3}/_{100}$ and $^{6}/_{100}$ gm. of gossypol. This proves that there is no oxyhaemoglobin reduction. The author carried out a number of experiments for the purpose of determining the effect of gossypol upon the oxygen capacity of the blood, using for the purpose fresh sheep's blood, both in its natural condition and also centrifugated in order to concentrate the corpuscles. The first determination of the oxygen liberated is made by adding 1 cc. of 1 % sodium chloride to 2 cc. of fresh blood, or corpuscles. Later, the author made similar determinations with 2 cc. of fresh blood, or corpuscles, to which had been added 1 cc. of 1 % solution of sodium chloride containing variable amounts of gossypol. The method used for determining the oxygen was Van Slyke's. The results obtained prove that even small quantities of gossypol suffice to hinder the liberation of oxygen from oxyhaemoglobin. This explains the principal symptom observed in the poisoned animal, viz., shortness of breath due to the affection of the muscles. Gossypol neutralises alkaline solutions, and when skaken up with them, produces a thick lather. Experiments to determine the haemolytic power of gossypol were made with centrifugated blood, the corpuscles having first been placed in suspension in a physiologic salt solution. The experiment was carried out at a temperature of 20° C. : 24 cc. of the diluted corpuscles were put into test-tubes containing variable amounts of gossypol and 1 cc. of a 0.6 % of sodium chloride was introduced.

The results obtained showing the hamolytic power of gossypol are given in 2 tables. The author continued his researches and studied the action on fish, perch being the species selected for the experiment. A $^{1}/_{1000}$ solution of gossypol proved toxic to the fish Oxygenated water does not destroy the toxicity of gossypol, but if it is added to unheated cottonseed-meal, it makes a solution of gossypol quite innocuous, probably on account of the action of a peroxide. The analysis of the blood and urine of an adult sheep that has been fed on cottonseed-meal shows

gossypol to have a diuretic effect, while the concentration of non-albuminous nitrogen and of sugar in the blood falls below the normal. It may be concluded that gossypol if taken into the digestive system is only slightly toxic, whereas when introduced into the circulatory system it at once becomes highly poisonous. Gossypol has a haemolytic effect upon the red blood corpuscles and causes death by reducing their capacity of transporting the oxygen of the blood, thus inducing hyperemia and œdema of the lungs, as well as dropsy, in the poisoned animals.

P. D.

397. **Experiment in Cattle Feeding.**

DERRICH, W. W. (Nebraska Experiment Station). Nebraska Feeders' Meeting. *The Breeders' Gazette*, p. 781. Chicago, 1923.

The author gives the results of an experiment carried out at the Nebraska Experiment Station with 3 lots of 10 young steers that had been fed during the summer a ration of grains and lucerne hay. Lot I received an ordinary dry ration : grain and lucerne hay. Lot II was fed the same ration and at the same time allowed to graze 2.9 acres of Sudan grass, while Lot III received the same ration and was turned into a 2.9 acre field of sweet clover. Lot I attained an average daily increase in live-weight of 2.90 lb. per head and consumed 682 lb. grains and 300 lb. lucerne hay per 100 lb. increase in live-weight. The average daily live-weight gain of Lot II was 2.79 lb. per head and the amount of food required per 100 lb. increase in live-weight was 672 lb. grains and 84 lb. of lucerne hay. The average daily increase per head in the case of Lot III was 2.80 lb. per head and the amount of food required per 100 lb. increase in live-weight was 678 lb. grains and 93 lb. lucerne hay.

Lots II and III were only given lucerne hay at the beginning and the end of the experimental period. P. D.

398. **The Development of the Dairy Cow.**

I. BRODY, S., RAGSDALE, A. C. and TURNER, C. W. (Department of Dairy Husbandry, University of Missouri, Columbia). The Rate of Growth of the Dairy Cow Growth in Weight After the Age of Two Years. *The Journal of General Physiology*, Vol. V, No. 4, pp. 444-449. 1 graph. Baltimore, 1923.

II. IDEM, The Rate of Growth of the Dairy Cow. The Relation Between Growth in Weight and Increase of Milk Secretion With Age. *Ibidem* Vol. VI, No. 1, pp. 21-30, graphs 3, Baltimore, 1923.

III. IDEM, The Rate of Growth of the Dairy Cow. Growth and Senescence as measured by the rise and Fall of Milk Secretion with Age. *Ibidem*, Vol. VI, No. 1, pp. 31-40, graphs. 3. Baltimore, 1923.

I. GROWTH IN WEIGHT AFTER THE AGE OF TWO YEARS. — In a preceding work, BRODY and RAGSDALE have shown that the increase in weight curve of a dairy cow during the first two years of its extrauterine life takes a cyclic course. In the present paper, they demonstrate that when the

cow is over two years of age, the curve resembles that of amino-molecular chemical reaction, viz., the percentage decrease in weight is constant in relation to the successive years. The authors collected and arranged a large mass of data referring to 14 000 cows entered on the Jersey Cow's Register of Merit. These animals were very homogenous and possessed at least the minimum points required by the American Jersey Cattle Club. The age of the animals ranged from 27 months to about 17 years; their average weight was calculated on the basis of a correlation table. The formula afterwards employed by the authors in plotting a graphic chart giving the relation of age to weight in pounds for the Jersey cow was as follows: $x = 960\ (1 - e^{-0.60\ (t\ -\ 0.77)})$, where x is the weight at a given age t, and 0.77 represents the duration of the intrauterine life. This is an instance of an equation of a mono-molecular chemical reaction $x = A\ (1 - e^{-kt})$, in which on account of the growth of the animal, the author rpresent its weight at full maturity. This weight is shown by the graphic chart to be 960 lb. in the case of the Jersey cow.

II. Relation between growth in weight and increase of milk secretion with age. — The authors show that the quantitative changes in milk secretion that occur as the cow becomes older (from 2 years to about 9 years), follow an ascending course, like that of the body weight, the two curves (of weight and milk secretion) are, however, quite independent of one another. From data obtained from the Jersey Register of Merit, the Shorthorn Register of Merit, and the Ayrshire, Guernsey and Holstein Advanced Register, the authors plotted a graphic chart showing the linear, or direct, proportional relation between the two phenomena. They also made use of the equation $F = 1.042\ 5\ W - 422.32$, in which F is the annual fat production of the milk per given body weight, W. Thus, after the animal has attained the weight of 472 lb., there is an annual increase of 1.0425 lb. of milk fat per 1 lb. increase in body-weight. Since the cow weighs 472 lb. at about 13 months of age, it follows according to Eckle's data that this equation expresses a general law and the dairy cow should begin to secrete milk after it is a year old. This has been practically proved, for it is well-known that heifers served at the age of 5 months, calve regularly when 14 months old. The equation therefore further shows that until the time of sexual development, there is no material development of mammary tissue.

In another graphic chart, the authors demonstrate the parallelism of both the processes studied and that both the curves (weights and milk secretion), could be represented by the same quation

$$x = (A - 1 - e^{kt})$$

in which x is the body weight, or the milk secretion at a given age, t, while e is the constant velocity which is approximately the same in both curves. From both graphic charts taken together, it can be seen that the two phenomena follow a similar course (that of a molecular chemical reaction); this makes it probable that growth is regulated by chemical action.

In order to discover wither the two processes were reciprocally independent, the authors studied separately the effect of the two factors, age

and body-weight upon the quantitative changes in the milk secretion. The method adopted, as the authors themselves recognised, was by no

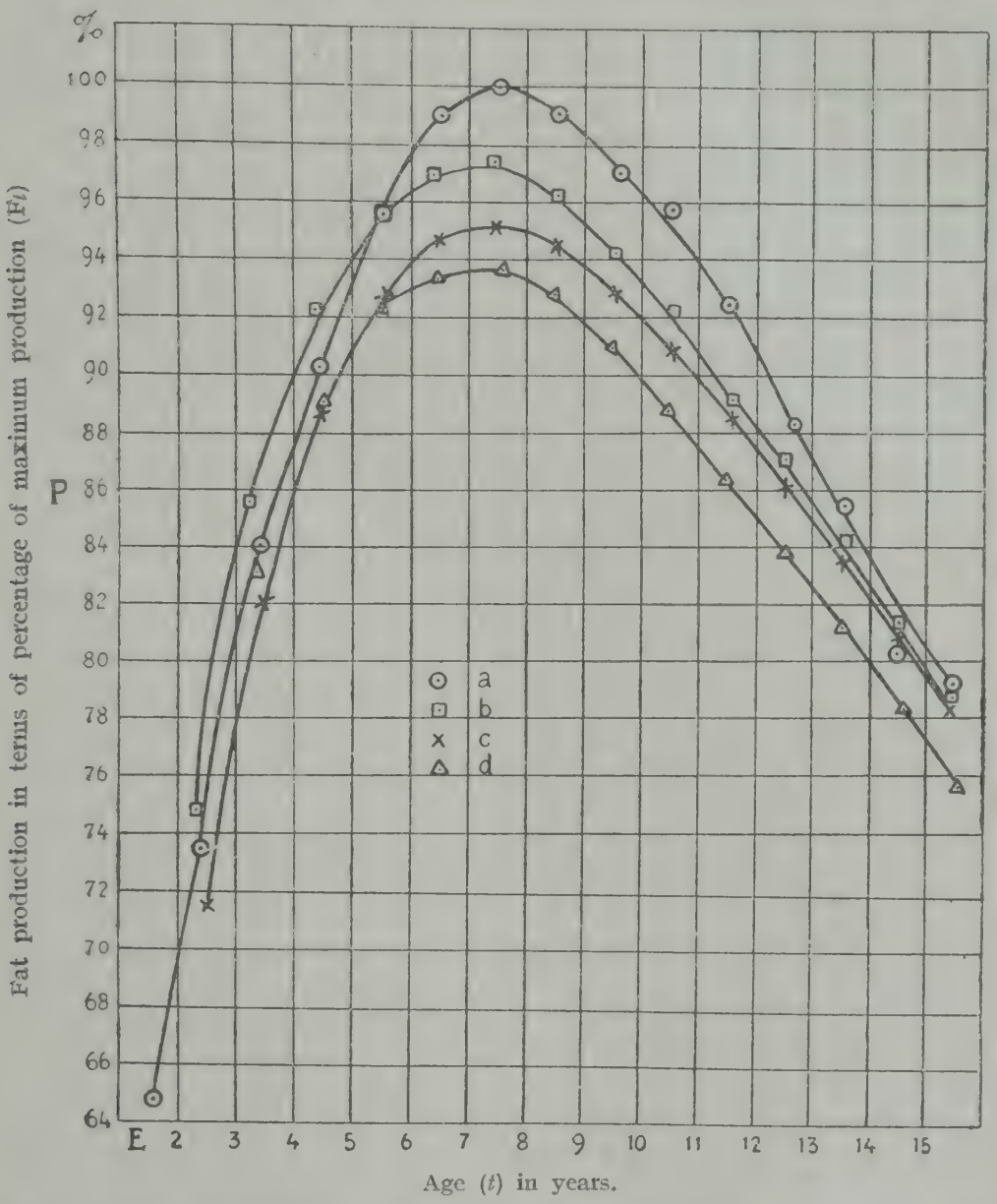

FIG. 61. — Comparison between computed and observed values of milk secretion with age for yearly records.

a (circles) = observed values.

b (squares) = values obtained from the formula $F_t = 142.4\, e^{-0,377t} - 126.15\, e^{-0,310t}$.

c (crosses) = values obtained from the formula $F_t = 142.4\, e^{-0,0377\,t} - 126.15\, e^{-0,310t}$

d (triangles) = values obtained from the formula $F_t = 142.4\, e^{-0.04t} - 120\, e^{-0.3165}$.

Observed values are based upon 45 984 yearly and 10 monthly records.

means exhaustive, since many other factors of no little importance should also be taken into account (factors of heredity, environment, etc.).

It would appear, however, that an increase of 100 lb. in body weight would be correlated with an increse of only 30 % in the annual yield of butter fat. The parallelism of the two phenomena (body-weight and milk secretion) from the age of 2 to about 9 years would seem to show that increase in body weight and in milk secretion is a reliable means of measuring the growth of a dairy cow.

III. GROWTH AND SENESCENCE MEASURES BY THE RISE AND FALL OF MILK SECRETION WITH AGE. — When the cow has attained the age of maximum growth (about 8 years), the body weight, since it remains practically constant, cannot be used any further to measure the effect of age upon the conditions of the organism, but milk secretion, which begins after the time of maximum development, and falls regularly as the cow grows older, could easily be used for this purpose, or in other words, is a reliable measure of senescence. The authors adopt the view that the rise and fall of the milk secretion curve are in relation to the age of the cow, and represent the rise and decline of its physical powers which are due to processes classified under the heads of growth and senescence of the organism. They have worked up a large mass of data (obtained from 150 544 cows) referring to changes taking place in milk secretion during the two above mentioned stages of life and have plotted graphic curves, one of which (see fig. 61) shows the fat production during the time of maximum milk yield. They have also devised a mathematical expression which not only represents the empiric curve, but is also rational in the sense of having been derived theoretically from a general natural law and of explaining the method followed in these researches. The authors do not approve of the formula used by PEARL and his collaborators (PATTERSON, MINER and GOWEN) : $y = A + cx^2 + d \log. X$ in which y is milk yield and x the age, for they share the view of LOEB and his fellow-workers (LEWIS NORTHROP etc.), who consider growth and senescence as two physico-chemical processes governed by the law of mass action and hence proceeding like a chemical reaction, since it is a general principle of chemistry that in a system of independent reactions the slowest reaction is the one that determines the course of the resulting process. On account of this fact, and because growth and senescence may be regarded as going on simultaneously with a continuous variation of reciprocally contrary velocity, it is possible to express the course of the whole curve made by the two processes by means of a mathematical formula representing the course of the simultaneous and consecutive chemical reactions that produce the whole life-process. This formula : $X \rightarrow Y \rightarrow Z$ where $X \rightarrow Y$ is the growth process and $Y \rightarrow Z$ is the progress of senescence, can be expressed by an equation of consecutive reactions, $Mt = (ae^{-k_1 t} - be^{-k_2 t})$ I in which k_1 and k_2 are the respective constant velocities of growth and senescence, Mt is milk production (or the index of physiological activity in relation to age), at a given age, and t and e are the basis of natural logarithms. From the graphic chart, it (fig. 61) can be seen that the above equation represents in a very satisfactory manner the course of milk secretion in relation to age.

399. **Normal Growth of the Jersey Cow.**

TURNER, C. W., RAGSDALE, A. C. and BRODY, S. (Department of Dairy Husbandry, University of Missouri Columbia, Missouri) *Journal of Dairy Science*, Vol. VI, No. 5, pp. 461-465, bibliography. Baltimore, 1923.

In this paper, the authors give the results of their studies of the weights of 15 680 Jersey cows entered by the American Jersey Cattle Club in the Register of Merit. These data may be regarded as typical of the American type of the Jersey breed. In addition to a table showing the correlation between age and weight, the writers have plotted a graphic chart from which it is seen that the Jersey dairy cow reaches its full weight (some 960 lb.) at the age of about 8 years. This figure differs a good deal from that found by ECKLES (902 lb.). The graphic curve may be represented by the equation: $X = A\,(1-l^{kt})$, in which X is the weight of the nimal at the age of t and A is its weight at maturity (in this case about 960 lb.). It would thus appear that the growth is due to the action of a particular substance and especially to an impetus given at the time of conception. This substance is gradually used up, and when it has been entirely utilised growth ceases; the weight of the animal may thus be regarded as an index of this utilisation, so that the difference between the cows' weight at maturity (960 lb.) and that at the age t will show how much of this substance still remains. Hence, the difference between 960 lb. and the weights at various ages would be as follows:

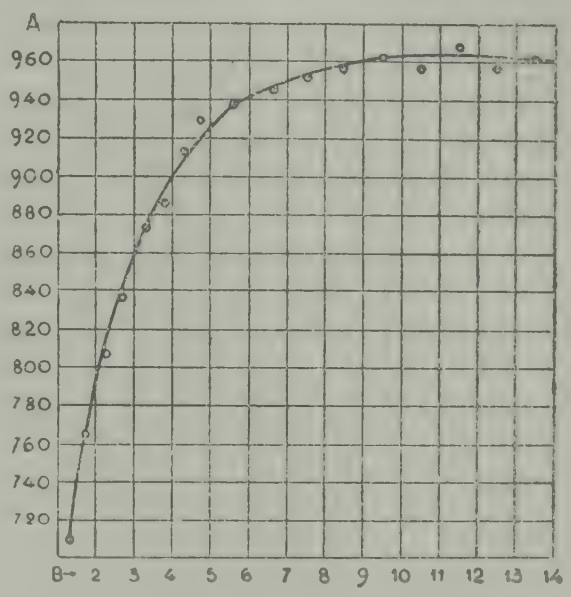

FIG. 62. — Age-weight curve of the Jersey cow.
A (vertical column) = weight in pounds.
B (horizontal column) = age-weight curve.

Average age	Weight	Differences	Percentage differences
years	lb.	lb.	
2.5	817	143	—
3.5	819	81	56.6
4.5	922	38	46.9
5.5	938	12	57.8
6.5	945	15	58.1
7.5	952	8	53.3
8.5	957	3	37.5

These figures show the percentage decrease in the substance, or in the growth impetus, to be nearly constant.

400 **Individuality a Factor Determining Variation in Fat Content of Milk (1).**

LANZILOTTI N. (R. Scuola di zootecnia e di Caseificio, Reggio Emilia). L'individualità considerata come causa di variazione del contenuto in grasso del latte di vacca. *L'industria lattiera e zootecnica*, Year XXII, No. 2, p. 23; No. 3, p. 39, Bibliography. Reggio Emilia.

In the autumn of 1915, the Ministry of Agriculture of Italy had some Schwyz and Simmenthal cattle imported from Switzerland. Certain of these animals were sent to the Royal Stock-Improvement Depôt of Reggio Emilia and were employed by the author in his work on the determination of the effect of individuality upon the fat content of milk. The cows were divided into 5 lots, each of which was strictly similar as regards breed, age, lactation, food, milking. All the 4 lots of Schwyz cows were composed of 3 cows of about three years of age that had calved nearly at the same time and were then in their first lactation period. The same person always did the milking and the 3 cows were fed exactly alike. The lot of Simmenthal cows consisted of 3 animals selected under the same conditions as those obtaining for the Schwyz lot. The daily ration was composed of 12 kg. good hay and 2 kg. maize cake. The fat content of the milk was estimated by the GERBER method for 12 consecutive days, samples being taken from the mixed morning and evening milkings. A study of the tables given by the author shows that the milk-yield of none of the cows remained constant, still less was the fat content uniform.

Individual Variations in Milk Production.

Name, or number, of cow	Average daily milk yield during 12 days of test	Average fat content of milk during 12 days of test
	Schwyz cows	
	kg.	%
No 2	12.1	3.2
3	12.6	2.9
6	10.3	3.2
7	12.3	3.0
9	10.2	3.4
10	12.2	3.2
13	11.1	3.0
14	10.9	3.2
22	15.8	3.3
25	10.2	2.9
36	9.6	3.7
37	9.1	3.2
	Simmenthal Cows	
Krone	7.9	3.8
Meiel	13.1	3.2
Rosolia	16.0	3.2

(1) See also LANZILOTTI Rassegna bibliografica sulle cause di variazione del contenuto in grasso del latte di vacca. Milan, Tip. agraria, 1923.

Many sudden changes, such as had been noticed by other experimentalists, are also to be observed. Owing to these abrupt variations and to the fact that every effort was made to neutralise as far as possible all other factors, the author considers that individuality has been proved to influence the fat content of milk. P. D.

401. **The Minimum Milk Requirement for Calf Raising.**

RAGSDALE, A. C. (Chairman, Department of Dairy Husbandry) and TURNER, C. W. (Instructor in Dairy Husbandry, Missouri Agricultural Experiment Station). *Journal of Agricultural Research*, Vol. XXVI, No. 9, pp. 437-446, tables 12, fig. 1. Washington, 1923.

Keeping the best calves of dairy breeds with a view to rearing them is one of the most difficult questions on a farm where whole milk is sold. There are two problems that present themselves in this connection: 1) the discovery of an adequate substitute for milk; 2) determining the earliest age at which weaning can be begun. The last point was studied by FRASER and BRAND and subsequently by FORMAN. The results obtained by these workers were such as to encourage the continuation and extension of the researches. In these experiments only pure-bred, or high grade, calves were used; every effort was made to keep them in good condition and as normal as possible in size and weight. The calves were given whole milk until they reached the age of 3 weeks, when the whole milk was gradually replaced by skim milk. Weaning took place at about the end of the second month, the animals being given dry food (without grazing) till they were 6 months old. The 30 calves were divided into two lots, the rations fed were separately weighed for each individual and a note was made of the food which was not eaten, though no attempt was made to limit consumption; Lot I received soya hay and a concentrated food consisting of 40 parts ground maize + 10 parts wheat bran + 10 parts linseed cake. Lot II was given: lucerne hay and a concentrate composed of 4 parts ground maize + 10 parts wheat + 10 parts ground soya-seed (the parts being calculated by weight). At the beginning of the experiment the calves were weighed 3 days in succession; later they were weighed every 10 days and the average of the 3 weighings was calculated every 30 days. The height at withers was regarded as giving the increase in height; this measure was take at the end of the experiment and every 30 days during the course of the experiment. The increased live weight in the case of the calves of Lot I was 64 % of the normal gain (previously determined by ECKLES) while the increase in height was 72 % of the normal increase. In the case of Lot II, the increase in weight was 68 % of the normal and 69 % of the normal in proportion to height. From the point of view of breed, the average gain in height and weight was greater in the Holstein than in the Jersey calves. Further, at the end of the experiment, the Holsteins were in better condition than the Jerseys, for they reached the normal height and weight at the age of 8-9 months, whereas the Jerseys did not attain normal full development before nearly a year. The Holsteins also proved superior to the Jerseys

in respect to the weight gained every 10 days. The following table gives some interesting figures showing the amount of food consumed during the experiment:—

TABLE I. — *Average Food Consumption per head.*

Lots	Milk	Concentrates	Hay	Crude digestible protein	Therms of net energy	Average daily increase in live weight
	kg.	kg.	kg.	kg.		gm.
I	27.44	193.85	166.17	41.77	527.57	431
II	37.76	205.10	129.22	38.78	516.75	454

TABLE II. — *Food Consumed per kg. of Increase in Live Weight.*

Lots	Milk	Concentrates	Hay	Crude digestible protein	Therms of net energy
	kg.	kg.	kg.	kg.	
I	0.75	3.90	3.24	0.80	10.76
II	0.85	4.33	2.25	0.77	10.40

About 70 % of normal growth can be obtained by weaning calves at the age of 60-70 days and feeding them a suitable mixture of concentrates and good quality hay. Once the animals are accustomed to the new diet, they increase further in height and weight. The amount of food consumed is an excellent index of growth. P. D.

402. Selection of Milk Sheep in Tcheko-Slovakia.

MACALICK, B. Un Troupeau selectionné de brebis laitière en République tcheko-slovaque. *Le Lait*, Year 4, Part IV, No. 32, pp. 105-107. Lyons, 1924.

A large number of sheep are bred for milk production in Tcheko-Slovakia, especially in the mountainous region of the Carpathians. The animals belong to different breeds, but chiefly represent the original unimproved races known as "valaque", "Cigaja" and "rackà." Some Merinoes, Southdowns and Friesian sheep are also to be found. The average annual milk yield per head is 60 kg. from which 12-14 kg. of ordinary cheese, or of the special varieties, "brindza", "ostiepeck" and "parnica", are manufactured. By improving the breed, the milk production could be doubled, for as much as 25 kg. of cheese per annum can be obtained from the milk of a ewe from a selected flock. Since 1915, milk control has been instituted in the State property at Vigàs. The flock is composed of 500 hybrid sheep (Cigaja × Friesian). The ewes for the selected flock were chosen on the supposition that the milk sheep

proving the best after lambing would also yield the most milk during lactation. The first selected flock consisted of 162 ewes, a further selection increased the number to 256. Milk control was carried out every 15 days with the following results: 36 % of the ewes gave over 400 cc. of milk a day and 51.7 % more than 300 cc. The maximum was 627 cc., the minimum 265 cc. and the average 351.6 cc. In the spring, the milk contained 6-6.5 % of fat, and in the autumn, as much as 10 %. It is proposed to continue the milk control with 2 flocks of Cigajas and pure Friesians.

P. D.

Goats.

403. **The Organisation of a Milking Competition for Goats.**

CHARON, AD. J. Concours laitiers pour chèvres. *Journal d'Agriculture pratique*, Year 88, Vol. I, No. 1, pp. 14-17, figs. 3. Paris, 1923.

The results obtained from the milking competitions in the case of cows had proved so satisfactory, that it was decided to admit goats also to these tests. The author studies the special organisation of these trials having due regard to the nature of the goat which is a very nervous excitable animal whose milk supply is apt to vary and even fail as a result of change of place, habits and food, or even of milker. According to the author, the institution of such competitions comes within the sphere of work of agricultural syndicates, or agricultural societies, and more especially of the official Departments.

The first point to be considered is the possible exhibitors, who must be acquainted with the conditions of entry and attracted by numerous prizes. It is a good plan to undertake to purchase at a high price all the male kids produced by the goats that are the latest prize-winners. The goat-owner taking part in the competition is required to measure the milk obtained at the various milkings during the day, and to enter the figures on a form provided for the purpose. The Secretary of the competition selects the twenty best goats from the data thus obtained, and informs the owners that the milk yield is to be tested again, but this time on the spot, and in the presence of a competent witness. From the figures recorded, the five best goats are selected, and the judges undertake to attend the third, and official definite test. By these means, a rigorous selection can be exercised at small cost, for all the worthless animals are eliminated the first day, inexact declarations and faulty measures are weeded out on the second day, while the conditions of the final test prevent any possible collusion on the part of local witness. In this way, select goats with high milk yield are obtained whose male progeny improve the milking properties of their descendants. The author advises the society purchasing the male kids of the best goats, in order to prevent their being sent to the butcher's and to insure future sires being suitably fed.

P. D.

404. **Application of Zoometry to Swine.**

DECHAMBRE P. and DEGOIS E. Evaluation du poids du porc par les mesurations. *La Revue de Zootechnie, la revue des éleveurs*, Year 3, No. 2, p. 86. Paris, 1924.

The measurements of cattle and horses have been the object of much research both with a view to determining the general conformation of the animals and their relative proportions, and also in order to estimate their live, or net weight. The formulae obtained are in general use and enable breeders to make useful calculations during the growth period of the animals, since the figures supplement and correct the impressions obtained in judging cattle by sight. So far, zoometry had never been applied to swine, but the authors have devoted their attention to discovering to what extent measurements are applicable in the case of pigs and the value to be attributed to them in weight determination. The chief measurements used are as follows:

1) Height at withers giving the height of the animal.

2) Height of back and sacrum showing the upper line.

3) Height and width of chest as an index of thoracis capacity.

4) Width and length of pelvis showing the breadth or narrowness, of this (region which is a factor of great importance in females) and the basis of the largest masses of muscle.

5) Length of body.

6) Circumference of cannon-bone as a basis for estimating the lightness of the skeleton.

7) the circumference of the chest measured at right angles to the spine.

8) The circumference of the chest measured obliquely.

9) The spiral circumference.

These measurements are taken by means of the lineal measure ("toise"), calliper and measuring tape. Pigs do not allow themselves to be so easily handled as cattle, but if they are treated gently, it is possible to obtain accurate measurements. The authors have applied the data collected by barymetric means; they took as their basis the facts that the weight of animals varies with their measurements, and that this is a proportion between certain measures and the live, or net, weight. The experiments were conducted on 35 pigs of 3 different breeds: 14 Craonnais ranging in weight from 69 to 133 kg. and a boar of 234 kg.; 10 Bayeux animals weighing 83 to 125 kg.; 9 Middle Whites of 82 to 113 kg., plus one sow of 190 kg.

In determining the live weight, the authors employed: 1) CREVAY's formula in function of the measurement straight round the chest; 2) QUETELET's formula in function of the oblique measurement across the chest; and CREVATS formula of the spiral measurement.

In the first case, the typical formula for cattle, 80 C³ had to be modified, since the coefficient 80 was too high, therefore 75 C³ were taken as the coefficient. With this, the results obtained were accurate enough in half the cases (error below 5 %), fairly accurate in one-fifth (error

below 10 %) but quite insufficiently correct in one-fourth (error above 10 %).

In using QUETELET'S formula in function of the circumference of the chest and the length of the trunk (C^2 L × 87.5), figures below the live weight found by weighing were obtained, therefore the coefficient 87.5 had to be raised to 100 because the weight of the head and limbs is usually more than 1/10 of the total weight of the pig. With 100 as the coefficient, good results were obtained in $^1/_2$ of the cases, fair in $^1/_5$/ and bad in $^1/_5$. In the application of the third formula, the coefficient 40 used in the case of cattle was lowered to 34, a figure giving more accurate results, only 6 results out of 35 being insufficiently correct.

The authors also studied the estimation of the net weight. DOMBASLES' tape gives the net weight when the measurement is taken obliquely round the chest (B). The formula in this case is $P = B^3 \times 29.5$, but the coefficient 29.5 can only be used in the case of animals with a dressing yield of about 50 %, while that of swine is 75-80 %. In order to make the coefficient proportionate to the dressing-yield, the authors raised the figure to 50 which gave very exact results in 7 cases, plus deviations in 14 cases and minus deviations in 14 cases. The net weight is calculated from the measure straight round the chest : the coefficient, which is 35 to 42 for cattle, must be raised to 55 for Crannais and Bayeux pigs and 60 for Middle Whites which give a larger yield. The spiral measurement round the chest (f) allows of the live-weight of cattle being calculated by means of the formula $P = 22\ f^3$, but the difference in the yield here again requires the change of the coefficient which becomes 26. The modified formula ($P = 26\ f^3$) gave 10 good results, 7 fairly good and 12 inadequate results. The conclusions arrived at from these researches may be summarised as follows. None of the methods employed insure the error not exceeding 10 %, therefore the classic barymetric formulae cannot be applied practically to swine. The results obtained are, however, interesting and supply their quota to the elucidation of the general problem of zoometry. P. D.

405. **Pig-Breeding for the Supply of Special Markets. (Great Britain, New Zealand, Queensland).**

I — STEWART, W. A. (M. A., B. Sc-Agr. Northamptonshire Farm Institute). Pig-Keeping. *The Journal of the Ministry of Agriculture*, Vol. XXX, No. 6, pp. 509-518, fig. 4. London, 1923.

II — GORRINGE, K. W. (Instructor in Swine-Husbandry, Live-Stock Division, New Zealand Department of Agriculture). Bacon Pigs ; Suitable Carcases for Export. *The New Zealand Journal of Agriculture*, Vol. XXVII, No. 4, pp. 235-240, figs. 5. Wellington, 1923.

III — SHELTON, E. J. (Instructor in Pig-Raising-Department of Agriculture and Stock). Classification of Pigs. *Queensland Agricultural Journal*, Vol. XX, Part 5, pp. 347-354, Tables 6. Brisbane, 1923.

I. — PIG-KEEPING. — Although during the last fifty years there has been an ever-increasing demand for pork-butcher's products on the

markets of England and Wales, pig-breeding has not advanced to the corresponding extent, with the result that in order to supply the requirements of the population, it has been necessary to import large quantities of pork and bacon from abroad ; much of this trade is at present in the hands of Danish exporters and breeders. The author first gives the two chief causes of this lack of development of the pig-breeding industry in the United Kingdom, viz., the fluctuating price of pigs, and legislative restrictions for preventing the spread of diseases of swine, and then passes on to describe the measures he considers should be adopted with a view to remedying the deficiency of output.

The aim of the breeder. — Pig-breeders must decide whether their object is to obtain fresh pork, or bacon, or both these products. The size and degree of fatness required in pigs destined to supply fresh pork differ in various districts although, as a rule, a pig weighing 120-140 lb. (dressing-yield 100 lb.) at the age of 4-5 months is preferred, but at Smithfield, lighter pigs are in request (live-weight 90-100 lb., dressing-weight 60 lb., age 4-5 months). In some of the industrial centres (North Midlands and the Black Country), fat pork is required, and the pig must weigh 240-300 lb. and have a dressing yield of 180-220 lb. The demand for fat pork is, however, strictly limited and often the supply exceeds the requirements, so that the price falls and therefore usually the surplus is made into sausages. Generally speaking, the less fat the pig, the higher the price it fetches per lb. The live-weight of the bacon type ranges from 200-220 lb. (dressing-yield 140-170 lb.) and the animals must be ready when 6-7 months old.

Extension of pig-breeding. —The pig-breeder should provide his own pigs by crossing them on his farm and thus obtain his stock independently of the market. The number of head should be sufficient to employ one person ; the author is of opinion that a single pig-man can look after 120 pigs. Taking this figure as the unit, it would require 12-15 well-bred sows and 1 boar to form and maintain the herd.

Capital required. — The initial outlay for pig-sties etc. varies. Good animals of known origin must be bought to be the progenitors of the breeding-stock. Such sows cost from £12 to £15, while £15 to £25 is paid for a boar fit for service. Reserve capital to the amount of £250 is necessary to meet current expenses until the first sales are made.

Pure-bred and cross-bred pigs. — Since uniformity of type is required in bacon pigs both by pork-butchers and breeders, it is necessary not only to raise the special type in request on the markets, but also keep the herd uniform by rearing true to type, pure-bred animals, or those derived from a first-cross. The brood-sows of the herd must also be uniform. The best breeds for the production of small pork are the Middle White and the Berkshire either pure, or inter-crossed. The Middle White pigs mature earlier, are more prolific and have white flesh. The same two breeds supply medium pork (average dressing yield 100 lb.). Hybrids resulting from the cross Middle White × Large White are bred in some districts, but require great care in rearing. The Middle White × Large

Black cross is now a great favourite. In certain Midland counties, the Berkshire × Tamworth cross is liked, the hybrids furnish good carcases, but as their development is slow, they are not very profitable. The Lincoln Curly-Coated pig has long supplied the heavy fat carcases required for fat pork. The Cumberland breed supplies similar heavy types and also excellent hams.

The best crosses to insure good bacon have not yet been definitely fixed, but hybrids, resulting from mating a Large White boar with a sow belonging to one of the heaviest races appear to find favour with the bacon curers. One of the most suitable of these heavy races is the Welsh (a recently registered breed). The Large Black sow is an excellent nurse and thrifty, but unfortunately these animals, like other coloured pigs, are sometimes seedy cut (have spots on the abdomen) which depreciates their value. The progeny of a Middle White boar and a Large Black sow are, however, not only early-maturing, hardy and vigorous but also supply good pork as well as good bacon. In conclusion, the author advises, in order to satisfy the general demand for pigs producing a good carcase as early as possible, that breeding-animals should be chosen which not only possess the usual racial characters but also have a light framework, since on the British markets, at all events, the heavy, large, fat pig of former days is no longer in favour.

II. — Bacon pigs, suitable carcases for export. — The New Zealand pig-breeders have succeeded, to a considerable extent, in capturing the British market for pork-products and especially for bacon pigs, but as the chief condition of success in this direction is the export of carcases of the desired type, the author describes the characters in request (great length, hams not too large, shoulders moderate in weight, lean and firm, but not stringy, back-fat uniformly distributed, firm compact, white and having an average thickness of 4 cm.). He shows how, after the hams and shoulders are removed, the rest of such carcases (viz., all the median part) is well proportioned as regards the successive cuts. The superior meat yield of a bacon carcase as compared with the fat type (very short carcase, back fat excessively thick etc.) is recognised.

Live weight:	"bacon" type	84.3 kg.	"fat type"	43.8 kg.
Dressing yield	»	»	63.4 kg.	»	»	56.6 »
Trimmings (not including head and feet) . .	»	»	5.4 kg.	»	»	10.2 »

Under the head of trimmings are included all the scraps of meat and fat cut off from the hams, shoulders etc., in order to balance the weight and render them more shapely for sale. Such small pieces are naturally of very small commercial value. Sometimes, however, although the carcase of the "fat" pig may give a dressing yield 1 ½ % higher than the "bacon" pig, the latter proves superior in other respects. In fact, although the bacon type appears the heavier, it loses about 8.5 % of its weight as compared with the 18 % lost by the fat type. The hams, while intact, represent 13.5 % of the carcase in the bacon type and 12.8 % in that of the fat type; when trimmed, the percentages were respectively

10.7 and 7.2, thus the meat yield in the case of the bacon type is actually higher.

The author draws attention to the fact that in some districts, where prime bacon carcases are produced, recourse has been had to cross-bred pigs since none of the pure-bred animals could satisfy the requirements. Various means are adopted to obtain the best carcases for export. In Denmark, the country exporting most bacon to Great Britain, the progeny of a Large White boar mated to a native sow are used; in Ireland, a Large White or Large Black (Devon) boar is mated with the Large White native sow, while in Canada a Tamworth boar is generally used to serve Berkshire and Yorkshire sows. In New Zealand, the Department of Agriculture will place at the disposal of breeders the progeny of Large Black and Large White pigs imported direct from England. Good results have already been obtained from the above mentioned crosses (Tamworth × Berkshire and Yorkshire).

III. — Trade classification of pigs in Queensland. — In order to insure the highest profits in the pig-trade it is not only neces-

Trade classification of pigs in Queensland.

Name of class	Approximate age	Approximate weight
Sucker or sucking pig	6 weeks	6.800 kg.
Weaner	8 »	11.300 »
Slip	10 »	14.500 »
Store	12-16 »	20.400 »
Light Porker	4 months	22.650 »
Medium Porker	4 1/2–5 »	31.700 »
Heavy Porker	5 1/2–6 1/2 »	43.000 »
Light Baconer	5 1/2–6 1/2 »	43 — 45.300 »
Medium Baconer	6– 7 »	54.350–56.600 »
Heavy Baconer	7–10 »	Up to 81.500 »
Back fatter	up to 7 years	» » 250.000 »
Stag	» » 5 »	» » 200.000 »
Boars	over 6 months	Various weights »
Choppers	up to and over 2 years	Up to and over 150 kg.

sary for the animals to be properly prepared for the butcher, or for the final fattening, but also for them to be suitably classified for the market. The following table, which gives the approximate figures, was compiled by the author in accordance with the various trade requirements.

On the markets, the demand for pigs of every age and class is rapidly increasing and whereas the trade price may range within wide limits, yet as a general rule, the average weight of the animal in each class may be said to be a constant.

Sucker, or sucking pigs. — The animals of this class can be sold, if in good condition, at the age of 6 or 8 weeks. The demand for them, however, varies considerably, but heavy profits can be realised with little trouble during the Christmas holidays. As a rule, the difference

between the live-weight and the dressing-yield of suckers varies between 18 and 25 %, although most breeders deducted 12 to 15 %.

Weaners, slips, stores. — The weaner is not a trade class ; on being weaned, the piglings enter the slip class which means they are passing from the " weaner " to the " store ". Many country pig-keepers prefer buying slips, or stores, for fattening rather than rearing them on their own farms. These two classes are in great demand on the market and fetch higher prices in proportion than pigs at a more advanced stage. The price of the weaner is from 15 to 20s. while as much as 30 or 40s. may be paid for the " store " which is readily bought (especially from the age of 5-6 months), by suburban pig-keepers and after 3-4 months fattening easily reaches the weight of a " medium baconer ".

Porkers, light, medium and heavy. — These pigs which are used for direct consumption are in constant demand on the market, where they fetch heavy prices, although there is a slight risk in rearing them to this point. Light porkers are less profitable than medium porkers except for suburban pig-breeders, who can easily put them on the market. During the cold months, medium porkers are in much request as they are sold retail, whereas the heavy type is only profitable when there is a large export of carcases ; indeed, it pays best to grow this type on for another month and sell the animals as baconers.

Bacon pigs : Light, medium and heavy. — The favourite bacon pig is of medium weight so that it can be easily cut up into hams, shoulders etc A lighter animal is too heavy for a " heavy porker " and too light for a baconer. The heavy type is more saleable than the heavy porker, for it has bigger hams, but it must never in any case be fattened longer than 10 months. So great is the demand for bacon pigs, that the breeders of this type have buyers and agents throughout the whole State.

Backfatters. — These have passed the stage of being profitably sold as baconers. They have heavy masses of fat on the back and upper portions of the body. Their commercial value is very variable, for the type includes very heavy animals, old fat sows or sows relegated to this class because they are useless for breeding purposes, very heavy, castrated bacon pigs that for various reasons could not be sold earlier. Usual prices : from 12 to 15 pounds.

Stags. — Old castrated, fattened boars. Demand very limited. Rarely profitable because they consume so much food.

Boars. — Old male animals. For these there is no demand on the market unless the purchaser has sufficient very cheap food to fatten them into " stags ".

Choppers. — Pigs put on the market before they have reached the degree of fatness required in the class to which they should belong, therefore this term includes animals of all classes from light porkers to backfatters. They are, however, very useful for commercial purposes, since they can be used to supply the retail trade and in the manufacture of good pork products.

G. Tg.

406. **The Cross Breeds Poland China and Large Black with Large White in Italy.**

PERGOLI, V. Le odierne conoscenze sull'eredità e la loro pratica applicazione zooteenica. *Giornale di Agricoltura della Domenica*, Year XXXIV, No. 7, p. 60. Piacenza, 1924.

For unexplained reasons, the pig breeds Poland China and Large Black, are neither prolific nor early maturing in Tuscany. Both are, however, well known for the good quality pork.

The Large White has conserved its original characteristics both as regards prolificness and early maturity but can on longer be termed a pure breed. The meat shows an excess of fat compared with lean. By crossing this with the two aforementioned breeds, the first generation possessed the early maturity of the large white and the superior meat qualities of the Poland China and Large Black. F. D.

407. **The Comparative Value as a Pig-Feed of Fish Meal and other Foods Rich in Albumin.**

Report of Experiments communicated by the "Administration centrale des Etablissements fédéraux d'essais et d'analyses agricoles", Liebefeld near Berne. (Administrateur central: Dr. A. SCHMID). Rapporteur: J. LANDIS, (Ing. Agr.). *Annuaire Agricole de la Suisse*, 1923, Part V.

Various circumstances have led to the demands for fish-meal which have increased to a remarkable extent in Switzerland during the past year, and since very contradictory opinions are held as to the advantages and disadvantages of feeding this product, it seemed advisable to institute some comparative feeding experiments with fish-meal and other substances containing a high percentage of albuminoids *e. g.* skimmed and centrifuged milk, meal and sesame cake, linseed and groundnut. The results of 28 analyses of fish-meal recently carried out in Switzerland proved that the samples contained on an average 52 % crude protein, 1.7 % fat, 25.6 % phosphate of lime and 3.3 % salt. These averages hold for the two brands of fish-meal used in the experiments. The tests were conducted on 4 large pig-breeding and pig-fattening farms, the animals being divided into lots each containing 5 to 10 pigs. The experiments lasted 12 to 15 weeks, and in two experiments, the animals were observed until the time that they were slaughtered, while the quality of the meat was made the object of detailed study on the part of impartial experts. The foods used in the experiments were given in increasing quantities up to 250 gm. per head and per day; the skim milk was fed in equal quantities as regards its albumin content viz., up to 3 kg. per day and per pig. The above amounts were consumed without any difficulty by the animals.

It should be mentioned that the skim milk produced a greater increase in live-weight than the fish-meal. On an average, it was found that the lots receiving cake gained practically the same amount of live-weight daily as those given fish-meal.

Neither the dressing-yield, nor the analysis of the fat, gave any reason for regarding fish-meal as having any bad effect upon the fat or the meat. It must, however, be admitted that for at least 4 weeks before the pigs were killed, the fish-meal had been omitted from the rations.

A coloured plate appended to the report shows in a very instructive manner the joints that are most important as criteria of the quality of the meat.

The experiments are not yet finished for, so far, fish-meal has not yet been tested in the capacity of a supplementary food rich in albumin. It is therefore intended to carry out further experiments to enable an opinion to be formed as to the secondary effects attributed to fish-meal, such as for instance, its property of stimulating the appetite of live-stock.

P. D.

408. **Raising Orphan Pigs, and Nutritive Ratio Studies.**

EVVARD, J. M., GLAYELTER, G. V., and WALLACE, Q. W. *Research Bulletin No. 79. Iowa State College of Agriculture and Mechanic Arts. Animal Husbandry Section*, pp. 443-493, tables XXV, figs. 3. bibliography, Ames, Iowa, 1923.

A large number of orphan pigs are lost yearly due to lack of experience and knowledge of feeding. A series of experiments has therefore been undertaken by the Iowa Agricultural Experiment Station (U. S.) to ascertain the most effective measures to be adopted, based on the principles governing nutrition and protein modifications of cows' milk.

The authors first discuss the nutritive value of milk, the percentage of ingested protein retained for growth, the possible deficiencies and the variation in the composition of cows' milk from different sources, and then compare cow's milk with human milk sows' milk, and that of other animals. Reference is made to the work of former investigators and the results of methods of artificial feeding of infants as applied to young pigs.

The experiment covered a period of 90 days ; — 30 days, milk limited to 2-3 lb. per day in conjunction with extra self-fed shelled maize, tankage and rock salt : — 30 days, as before, but milk at the rate of 3 lbs per day ; — 30 day, milk discontinued, self-fed as before. The piglings were selected from different litters of large type Poland-China sows, which had been well fed before farrowing.

From the results obtained it had been concluded : 1) that cows' whole milk plus standard ration of mixed shelled maize (yellow type preferred) plus self-fed 60% protein meat meal tankage plus rock salt, produces a healthy animal. 2) 1 quart of cows' whole milk per pig daily in three or more feeds is practicable if allowed a self-fed ration of shelled maize, tankage and salt ; 3) although a modification with casein, blood meat and linseed oilmeal appears to give better results in the suckling stage, the practice is questionable ; 4) milk fed three times daily after the pigs are well started combined with the standard ration, appears to be satisfactory ; 5) in the most successful tests, the crude nutritive ratio averaged about 1 : 3.8 (protein : carbohydrate), considered by the authors as " appetite manifestation " evidence.

M. L. Y.

409. **The Creation of Industrial Piggeries.**

GOUIN R. Conseils pour la Création d'une Porcherie industrielle. *Revue de Zootechnie, revue des éleveurs*. Year 3, No. 1, pp. 8-16, tables 2. Paris, 1924.

The economic conditions of the industrial production of pork differ essentially according to the circumstances under which the agriculturist is working. In an industrial establishment, where the pig-food is bought in the market, it is easy to calculate the net cost of the ration, while by carefully following the development of the pigs, the second factor necessary for estimating the net price per kg. of pork is obtained. In an industrial piggery, it is necessary for this calculation to be made somewhat frequently, in order to be able to determine, by watching the market, the best time to sell so as to obtain the largest profit. The factor of " general expenses " must never be lost sight of ; it varies with the farm, although the author fixes it at about 0.40 fr. per head and per day. The daily increase in weight per head should be determined by weighing in order that it may be possible to modify the rations at the right time and weed out unprofitable individuals. Although the food question is paramount, attention must be paid to hygienic conditions : temperature, quiet, cleanliness, punctuality in feeding, all of which may exert a beneficial, or baleful, influence. The author mentions one practical instance : at the Elsesminde Breeding Station, 1 kg. increase in live-weight is obtained by feeding 3 kg. of barley, whereas on a farm, 4 or even 5 kg. (in winter) are needed to obtain this weight. These details are of special importance in an industrial piggery on account of the number of animals kept and the value of the food used.

The chief point to be aimed at is a system of feeding calculated to supply the organism with all food elements it needs for reaching maximum development in the shortest time, and at least cost. It is necessary to diminish the risk of loss by the use of varied foods. The author mentions the favourable effect of a narrow nutritive ratio in rearing and fattening swine. In industrial piggeries, the daily rations must be calculated according to tables so as to avoid waste. The author calculates the rations as follows : 1) an estimate is made of the digestive protein necessary for the development of the tissues ; 2) the food value is calculated in starch required for the production of energy, heat and the formation of the fat deposits. By adding 1 and 2, the amount of the ration is found. As soon as this has been estimated, it is tested ; here the skill of the breeder is shown, for he must know how to modify the ration according to individual requirements, and interpret judiciously the results obtained. Only one change must be made in each trial, after which the original ration is fed again, the increased requirements being taken into account, and the individual peculiarities eliminated by using a large number of animals.

On of the most favourable conditions for starting an industrial piggery is to have at its disposal a considerable amount of waste products of animal origin, but these must not be too freely used. The author has

obtained 600 gm. increase in live-weight daily from feeding the following mixture to swine weighing 50 kg. 1.500 kg. tripe and 1.500 kg. ground ryes. This mixture is given cooked. In place of rye, maize, sorghum and potatoes may be used. When blood is given, it must be collected while fresh and clean, and fed after cooking, otherwise enteritis may be produced. To these rations should frequently be added green, chopped forage in order to provide the vitamines that are indispensable. Therefore it is necessary to give careful consideration to the price of these foods and to make estimates so as to have the pigs ready for sale when a balance between the cost price and the price per kg. is reached. It generally pays best to sell the pigs at as early an age as possible, provided the prices are equal, but the State of the market must be kept in view. A last question to be considered is the age at which it is best to buy porkers for fattening.

As the net cost per kg. is lowest in the youngest animals, advantage must be taken of the first months when the margin of profit is greatest. As a rule, however, it is not advisable to choose piglings, when just weaned unless there is a large quantity of whey at disposal, since such young animals are more liable than others to rachitis and that much dreaded disease, pneumo-enteritis. Older pigs generally give a more satisfactory economic balance. To sum up ; if an industrial piggery is to prove highly profitable, the different problems that arise must be solved by calculation.

P. D.

Poultry.

410. **Poultry-Feeding Experiments and Laying Control.**

I. — Hofman, Bang N. O. Fodringsforsøg med Høus. 112te. *Beretning fra Forsøglaboratoriet* udgivet af den Kgl. Veterinaer- og Landbohøgskolos Laboratorium for Landøkonomiske forsøg, No. 112, pp. 1-61, figs. 3. Copenhagen, 1923.

II. — Holm, R. Nolge Erfaringer fra Kontrolaegloegnigen paa Lundsgaard 1915-1921. *Ibidem*, No. 112, pp. 62-55. Copenhagen, 1923.

I. — *Poultry-feeding experiments.* — These experiments were conducted at two different places, Lundsgaard and Trollesminde, under favourable conditions. At Lundsgaard, the birds used included fowls that had been reared on the farm and also others that had been purchased, while in the Trollesminde experiments, all the hens had been raised on the premises. Fowls of one and of two years old respectively were employed in these feeding experiments. The birds were divided into different lots according to their weight and origin, while the hens of each breeder were put into different groups. Where birds of two years old were employed whose laying during their first year was known, care was taken that the hens of different laying capacity were distributed among the different lots. In the same way, the amount of food fed the birds during the first year was taken into account. The egg-laying control was carried out by means of trap-nests. The eggs of each group of hens were weighed daily, but no record was made of the weight of the eggs laid by the individual birds. During the first years, the experiments

lasted for 12 months; subsequently, the experiment year was limited to 11 months, because the month of November when egg-yield was lowest, had been selected as the time for throughly cleaning and disinfecting the fowl-houses. All the birds, both cocks and hens, used during the trial year and intended for employment in the rest of the investigations were subjected to the tuberculin test. Any bird reacting to the test was immediately destroyed and examined, while a post mortem examination was made to ascertain the cause of death in the case of any of the poultry that succumbed during the course of the experiment.

Owing to these measures, the condition of health of all the birds gradually became excellent. The hens always had free access to water, charcoal, and lime. As regards the data of the results obtained, it should be stated that the number of eggs per fowl as given in the table represents the average number of eggs laid by the hens that lived throughout the experiments and laid eggs. The report does not include the eggs produced by birds that died during the experiment; in the same way, non-layers are regarded as non-existent.

The feeding experiments were directed to several different questions:

1) More or less liberal feeding:
   (*a*) limited rations, more or less liberally fed,
   (*b*) limited rations and food placed at the free disposal of the birds.
2) Comparison between cereals and potatoes.
3) Green food and no green food.

1) (*a*) *Limited, but more or less liberal rations.* — This experiment extended over four years and was carried out at Lundsgaard on barred Plymouth Rocks. Two sets of experiments were made with fowls one and two years old respectively. On an average, the less well-fed birds each received 87.5 gm. of food per day, while the better fed birds were given 105 gm. In addition to these rations, all the hens were fed beet-roots and chopped lucerne hay in winter, and green food, in the runs in summer. Rather more eggs of slightly larger size were obtained by raising the ration to 105 gm. instead of 87.5 gm., but it does not follow that this would always be the case, for much depends on the egg-producing capacity of the hen.

Fowls laying many eggs need more food than poor layers, for which reason it is useless to give a general rule as to the rations to be fed to hens.

1 (b) *Limited rations and food given ad lib. to the birds.* — The great question was how far the fowls themselves could be trusted to know how much they should eat. It was feared that the birds would become too fat, but American observers maintain that their hens only ate what they needed provided the food placed at their disposal was composed of dry and ground substances. The experiment was made at Lundsgaard with two pens of purchased barred Plymouth Rocks. Both lots were given a limited ration of 75 gm. cereals + 10 gm. ground food (linseed cake, blood meal and ground peas), as well as beets and chopped lucerne hay in winter, and green food in summer. One of the lots had in addition as much as it required of a dry, ground food mixture of the same com-

position as that of the limited ration. One year-old bird ate 30 gm. a day while another bird of two years old ate 27 gm.

Hens	Aged 1 year		Aged 2 years	
	limited rations	food *ad lib.*	limited rations	food *ad lib.*
No. eggs per hen	84	123	81	92
Weight of eggs per hen	4.71 kg.	7.09 kg.	3.59 kg.	5.54 kg
Average weight of egg	56.1 gm.	57.6 gm.	58.9 gm.	60.3 gm.

Thus, liberal feeding was very profitable. On weighing the fowls, it was found that the birds that had eaten as much as they wished were not over-fat, although their weight slightly exceeded that of the hens fed limited rations.

2) *Comparison between cereals and potatoes.* — If potatoes are introduced into the ration, they must be bought in the cheapest possible market. The potatoes are fed hot after being boiled : the substitution of potatoes for cereals is effected on the basis of the dry matter content. The fowls refused to consume more than 180 gm. of potatoes a day. In the Lundsgaard experiment, hens one and two years old were employed. The results showed that when potatoes were substituted for cereals on the basis of the dry matter content (three rations of potatoes for one ration the cereals), the hens given the potatoes laid fewer and smaller egs and put on less weight.

Green food versus no green food. — In order to demonstrate the supposed beneficial effect of green food upon poultry, experiments were carried out at Lundsgaard with two year-old Plymouth Rocks and at Trollesminde with Plymouth Rocks and Italian fowls of one and two years of age. One of the two lots of hens was kept in a grass-run and received in winter as much chopped lucerne hay as the birds wished, and in summer green lucerne *ad lib.*, while the other lived in a court bare of grass and was fed no supplementary rations of hay, or fresh lucerne. The rest of the food was the same : 75 gm. (maize, barley and oats in equal proportion) and free access to a dry ground feed that was composed at Lundsgaard of equal parts of maize, barley, oats and blood-meal, while at Trollesminde, it consisted of 1 part maize, 1 part barley, 1 part blood-meal and 2 parts wheat bran. The results obtained were as follows :

Lundsgaard — Hens 2 years of age.

	Green food	No green food
No. eggs per hen	132	90
Weight of eggs per hen kg.	7.79	5.36
Average weight per eggs gm.	59.0	59.6

Trollesminde — Hens one year old.

	Plymouth-Rocks		Italian	
	Green food	No green food	Green food	No green food
Hens of 1 year of age:				
No. eggs per hen	186	149	140	129
Weight of eggs per hen kg.	10.56	8.41	7.85	7.20
Average weight of eggs gm.	56.8	56.8	56.1	55.8
Hens 2 years of age: (six months' experiments)				
No. eggs per hen	46	43	44	46
Weight of eggs per hen kg.	2.84	2.68	2.62	2.66
Averagé weight of egg gm.	61.7	62.4	59.5	57.8

The variation in the results was greater at Lundsgaard because the grass there was strong and fine and green in tufts, whereas in the new runs at Trollesminde, it was scanty and poor. Want of green food seems to be harmful to the health of animals, especially when the latter are young, and is particularly injurious in the case of Italian fowls. Unlike the Lundsgaard fowls, the Trollesminde Plymouth Rocks that were given green food did not take more of the foods given *ad lib.* than the fowls which received no green food. This applied both to the one and two year old birds, but the Italian fowls which were given green food ate more of the other foods to which they had free access than those fowls which received no green food.

The chief results of the above-mentioned feeding experiments were as follows:

1) Increasing the daily ration from 87.5 gm. to 105 gm. per hen increased the number and average weight of the eggs. It is impossible to say how much food is habitually required by fowls, for this depends upon the laying capacity of the birds and also on other factors.

2) If hens are given free access to a dry, ground food, they lay larger and more eggs than if they are given limited food rations. Free feeding does not make the hens fat, and is an easy method to adopt.

3) Even if cereals are replaced by a treble weight of boiled potatoes, hens fed on potatoes produce smaller eggs than those given cereals.

4) Including a liberal supply of green food in the rations causes the hens to lay earlier and produce more and larger eggs than can be obtained in the absence of green food. Lack of the green food is injurious to the health of the birds, especially to that of hens that are one year old.

III. — *Some experiments resulting from the egg control carried out at Lundsgaard in* 1915-21. — Some years ago, a fowl-house was built at Lundsgaard where the Danmarks Fjerkreavler-forening (Members of the Poultry Breeders' Society of Denmark) could have 20 lots of hens each of 6 birds controlled annually. The testing was carried out by means of laboratory experiments, and upon young birds ; it only lasted 11 months, as one month was needed for the clearing and disinfection of the hen-house. During the years in question the following number of eggs was obtained.

1915–16	130
1916–17	130
1917–18	142
1918–19	134
1919–20	157
1920–21	145
1921–22	144

After working up the material, E. Holm found the chief results to be as follows :

1) It may be taken as a general rule that pullets which begin laying early will produce more eggs the first year than those which begin laying late.

2) Young hens laying many eggs in the winter usually lay many eggs in the summer.

3) If the chicks have been properly reared at the right season-it is generally advisable to weed out all the pullets that have not pro, duced eggs before March 1. This allows the least fertile hens to be eliminated from the breeding stock.

4) Pullets increase in weight up to March 1, after which their weight falls during the spring months, to rise again in the course of the summer and autumn.

5) At Lundsgaard, the large fowls ate more of the food fed *ad lib.* than the smaller birds consumed, but without producing a greater weight of eggs.

(*Corr. Denmark*).

411. **Poultry Feeding Experiments in Australia.**

Rugg, W. C. (Chief Poultry Expert). Australian Feeding Experiments. *The National Poultry Journal*, No. 194, p. 598. London, 1924.

The author gives the results obtained during the first 8 months of a poultry-feeding experiment conducted at Weribee Research Farm. The experiment was made on 3 lots of 36 white Leghorn pullets, kept and fed under the ordinary farm conditions. The rations were fed as follows : Lot I had free access to the troughs containing the different foods used in the experiment and green food was placed at the fowls' disposal. The birds in Lot II were given moist paste *ad. lib.* ; chopped green food was distributed morning and evening, while they received their grain

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as a scratch-food scattered in the straw in the evening. Lot III received dry paste in the morning, chopped green food at noon and grain as a scratch food in the evening.

The following table gives a summary of the experimental results obtained during the period from April 1 to November 31, 1923.

Pen	Food consumed	Paste (lb.)	Grains (lb.)	Total (lb.)	Eggs laid
1	Free Choice	371 1/4	1450	1820 1/4	4302
2	Moist paste	692 1/4	1190 1/2	1882 3/4	4049
3	Dry paste	752	1098 1/2	1820 1/2	4232

P. D.

412. External Characters a Guide to Culling Bad Layers.

LEGENDRE, G., L'élimination des mauvaises pondeuses d'après l'examen de leurs caractères extérieurs. *Revue de Zootechnie*, Year 2, No. 8, pp. 147-154, fig. 1. Paris, 1923.

The author, while recognising the value of HOGAN'S system (1) for choosing good layers, and mentioning the satisfactory results he has obtained from this method, states that the exclusive adoption of the above system in poultry farms has certain economic disadvantages. Although America and England produce a wonderful number of eggs, they are beginning to feel the want of a good table-fowl. The economic imperfections of the methods hitherto devised for obtaining a good layer have led to the fowl itself being regarded from another utility point of view. In the opinion of the author, it is necessary also to take into account: 1) the vitality of the bird as shown by its true fertility which can only be proved by the final hatching results, and not solely by egg production; 2) the capacity of the hens to produce fine fowls which can be gauged by keeping in mind the following scheme:

		Coefficients:	
Early maturity		2	2
Quantity	Weight	4	12
	Fineness of frame	1	
	Breast	5	
	Width of back	2	
Quality	Colour, skin and meat	3	6
	Texture	3	

G. Tg.

(1) The Hogan system and its derivatives consist in the estimation of the value or suitability of a hen, by examination of the external characters: 1) the distance apart of the pelvic bones (which in good layers should be about three fingers width) and between the pelvics on the one hand and the points of the breast bone on the other (which should be about four fingers width); 2) the skin should be soft and flexible; 3) moulting should be late; 4) yellow pigment (absent in Mediterranean breeds). (N. B. E.)

413. Goose-Breeding in South-West France.

REY P. (Eleveur agriculteur). L'Elevage de l'oie dans le Sud-Ouest de la France. *La vie agricole et rurale.* Year 13, vol. XXIV, No. 6, p. 89-91. Paris, 1924.

The grey goose is bred in most of the agricultural farms of France which are near a stream or pond. This bird is of average size and weight, its neck is long and thin, and its beak strong. The neighbourhood of water is necessary in order to insure the eggs being fertilised. The female is very prolific, laying on an average 60 eggs annually on which, however, she does not sit The laying season begins in February. In order to hatch out the eggs it is necessary to have recourse to hens that have just finished their first laying period, to turkey-hens that have not yet begun to lay, or better still to an incubator with which good results can be obtained if sufficient care is taken. Since the goslings are not looked after by the hens that hatch them out, it is very difficult to rear them during the first fortnight. Their chief enemies are: cold, damp, rats, cats, dogs and pigs. After this critical period has passed, the survivors are almost certain to do well. Every farm possesses a " jeu d'oies " viz. a gander and three geese. The returns would be considerably increased if two ganders and six geese were kept, but this would entail certain precautions. The ganders must be given their liberty alternately every other day. Some farmer's wives sell their geese at the age of 15 days, though others prefer turning the birds out to grass for two or three hours daily and then selling them before, or after, the harvest. Where there are large stubble fields, the goslings may be allowed to glean the scattered grain ; birds thus fed grow very fine and have a higher market value than others. They are sold when adult, in November, and are then ready for fattening. It costs little to keep breeding-geese. From November to May, they are given 3 litres of oats per day and per set in order to stimulate them and insure fertile eggs. Adult geese are fattened in December, the cramming process lasting a month or six weeks, each bird receiving 25-30 litres of dry maize during the whole period. After careful fattening, the geese weigh 8 to 9 kg. and easily fetch a high price on the Toulouse market.

The Gascon goose is subjected to much treatment to prepare it for the table. Its cramming takes 7 to 8 minutes a day. On all the small farms, 12 adult geese can well be fattened. Six of the birds are sent to the market, while the other six are reserved for home consumption. The liver of fatted geese is much liked by " gourmets " and is sold at a high price on the market. An additional profit is obtained from the scale of the down and feathers of which 12 geese produce about 4 kg. An improved breed has been obtained by selection ; viz. the Toulouse goose which can reach the weight of 12 or 13 kg. while its liver may weigh from 1 kg. to 1.5 kg.

P. D.

[413]

Sericulture.

414. **Silk from East Africa.**

Bulletin of the Imperial Institute, Vol. XXI, No. 4, pp 581-585. London, 1923.

Results of investigations with mulberry silk cocoons from Kenya and Uganda. On examination by the Imperial Institute Advisory Committee on Silk Production it was stated that the yield of silk from Kenya cocoons was satisfactory, and that the industry should be encouraged. As regards industrial value, the reeled silk was reported to be of good tensile strength, although of medium elasticty. This applies also to the material from Uganda but the results may be considered promising. It is recommended to develop the industry locally before attempting export to Europe on a large scale. M. L. Y.

415. **Sericulture in Brazil.**

Vantagens da criação do bicho da seda. *Revista Agricola, Industrial e Commercial Mineira*, Vol. I, Pt. III, p. 214. Bello Horizonte, 1923.

Repeated experiments have shown clearly that the mulberry is very successful in Brazil and that conditions are favorable to sericulture. As many as 4-6 broods have been reared annually. Where the chief crop is coffee, the breeder has the great advantage of occupying the intervening season with silkworm rearing. According to the report of the Director of the "Estaçao sericola" at Barbacena (Minas Geraes), the production of 1 ounce (30 gm.) of silkworm seed will entail the following cost:—

Silkworm "seed" 15 *milreis*; leaves 30 *milreis*; 30 days of labour at 2.5 *milreis*, 75 *milreis*; miscellaneous 25 *milreis*; total 145 *milreis*. This should supply on an average 50 kg. silk, sold at the rate of 6.5 *milreis* per kg. *i. e.* total of 390 *milreis* with a profit of 245 *milreis*. F. D.

Pisciculture.

416. **Dropsy of the Umbilic Bladder of River Trout.**

PATTE T, L. Hydrocile de la vessie ombelicale chez les alevins de truites de ruisseau. *Bulletin suisse de Pêche et Pisciculture*, Year 24, No. 4, pp 41-42. Neuchatel, 1923.

The author has made a special study as to the etiological cause of the serious epizootic infection of the umbilical bladder which has been observed in river trout at Chenaleyres (Switzerland) relative to the therapatic-prophylactic measures which were employed the preceding year, also with trout in the same locality, to combat another very serious epizootic disease of the ribs. A formaline solution (LEGER formule 7 cub. cm. in 20 litres of water) was employed, but the fisherman who had continuously sprinkled the young fry with this solution had unfortunately followed this up by using a double strength formaline solution believing this to be more effective. The author considers, however that the use of this concentrated solution was probably the cause of the dropsy. G. Tg.

417. **Note on Stocking Waters with Trout.**

COURVOISIER, J. Quelques remarques sur l'alevinage des truites et suggestions pour son amélioration. *Bulletin Suisse de Pêche et Pisciculture*, Year 25, No. 1, pp. 6-7. Neuchâtel, 1924.

The author draws attention to the fact that it is mistake to stock streams and rivers in Switzerland chiefly with the eggs of large female lake-trout fertilised with the milt of male lake-trout, since in this way, fry are obtained that either from atavism, or instinct, make every effort to return to the lake and thus are lost from the point of view of restocking. Hybrids between female lake-trout and male river-trout are not very satisfactory. It is necessary to obtain pure-bred fry of the red-spotted river-trout, although this takes a long time and entails overcoming many difficulties. P. D.

FARM ENGINEERING.

418. **Construction of the Wind River Diversion Dam in Wyoming (U. S.).**

The Reclamation Record, Vol. 15. No. 1, p. 12, figs. 2. Washington, D. C. 1924.

The construction of the dam was begun in July 1921 at a cost of less than half a million dollars, and will provide for the diversion of water from Wind River for the irrigation of more than 100 000 acres of otherwise arid land (State of Wyoming, U. S. A.). R. D.

419. **Ploughing without turning the Furrow.**

BATTISTELLI, E. L'aratura senza rivoltamento. *La Riforma Agraria*, Year V, No. 1, pp. 14-16. Parma, 1924.

The author investigates theoretically KALLBRUNNER'S article which was published in the *International Review of the Science and Practice of Agriculture* No. 3, 1923. After giving a succinct and clear summary of the paper, he makes the following observations.

If we consider the importance of air from the standpoints only of soil biology and the root physiology of plants, the present methods of ploughing appear to be very satisfactory. Ordinary ploughs with land-side plate leave the turned slice at an angle of 45° with the surface of the ground, thus facilitating the breaking up of the slice, and the clearing of the furrow; by this means the original arrangement of the strata is altered, while a larger amount of air is introduced between the clods. Aeration is the chief object of working the ground for although it is true.

that breaking up the soil (ploughing without turning the furrow) increases its porosity and stimulates the vegetative and functional activity of the aerobic micro-organisms and hence promotes the diffusion of air, yet the pulverised soil quickly loses its mellowness owing to the action of external agents (heavy rain alone is sufficient for this purpose). The utmost that deep breaking up the soil can do is to retard the inevitable caking.

Breaking up and pulverising the soil till it assumes a very fine texture increases its water-holding capacity and may decrease the circulation of the air owing to the rapid caking of the soil, since the water by removing the carbonate of lime disintegrates the soil particles and dissolves the colloids (clay and gelatinous compounds), which fill up the spaces between the clods.

In poorly-aerated soils, the injurious process of acidification may be set up as a result of anaerobic conditions that cause a reduction of the organic detritus.

The formation of large clods is not prevented by ploughing without turning the furrow, but it can be hindered by the surface ploughings that precede the operations of the gang-plough.

It is also doubtful how far ploughing without turning the furrow is really economical, for superficial ploughing and pulverising combined with thorough, deep ploughing can well replace the repeated breaking up of the soil as a means of combatting crust formation.

Further, the mouldboard has a tendency to reduce the traction force that would otherwise be required of the ploughshare and coulter, because it opens the furrow and raises the slice.

Finally, a somewhat uneven surface at seeding-time allows of the seed being drilled, while the clods protect the seedlings and support them to a certain extent. Hence in the opinion of the author, ploughing without turning the furrow cannot in any way be recommended from the agricultural standpoint. F. D.

420. Efficiency of Subsoiling.

Journal of the Surveyors' Institution, Vol III, No. 9, p. 479. London, 1924.

The results are now available of a five years trial of subsoiling carried out by the Ministry of Agriculture (London) in co-operation with the East Anglian Institute of Agriculture. The soils chosen were London clay, boulder clay, brickearth, sand and gravel. Fields were divided into strips, some of which were ploughed and subsoiled to depths of 5, 7 and 9 inches, and the remainder ploughed only. The subsequent treatment of the plots was identical.

The results have shown that in every case a greater yield has been obtained from the subsoiled plots than from plots which were ploughed only. The maximum increase was 67 % in the case of potatoes, and 50 % increases were frequently obtained. The value of the extra yield, on every occasion, more than paid for the increased cost

The trials are to be continued for a further 4 years, and new plots are to be laid down in the Oxford area. W. S. G.

421. The Russian Tractor Industry.

JEMTZEFF, WLADIMIR. Die neuesten russischen Traktor-Konstruktionen. *Die Landmaschine*, No. 15, pp. 203-205, figs. 4. Berlin, 1924.

According to the estimate made by a Russian Official Technical Commission, Russia would need during the next 10 years, 2 400 000 H. P. (corresponding to 120 000 tractors of the average 20 H. P.), in order to replace animal traction by mechanical traction in only 40 % of the total agricultural work.

The purchasing power of the rural population is very limited and the price realised by the sale of the crops of these 10 years would only buy 50 000 tractors at most.

The types of machine best suited to the conditions obtaining in Russia are 15-30 H. P. wheeled tractors and 20-50 H. P. caterpillar tractors. In both cases, the fuel used must be petroleum, naphtha, or other heavy oil. The most widely used machines are at present the American tractors "Titan" and "Holt" and the Russian tractors, "Gnom," "Saporoschetz" etc.

A scheme has been draw up for entrusting the construction of 600 wheel-tractors to the "Aksai" firm (Rostow on the Don), 1200 caterpillar tractors (of 50 H. P.) to the engine-factory at Charkow, and 1600 wheeled tractors to the Petrograd factories. It has been estimated that the proportion required is $^2/_3$ wheeled-tractors and $^1/_3$ caterpillars. The credit granted for the year 1924 amounts to 2 336 000 gold roubles.

The characteristics of the Russian type of tractor correspond to the requirements of the country and are as follows: great simplicity of construction, solidity, and power of running on heavy oils. The materials used must be very durable and found within Russian terrritory to enable repairs to be made cheaply on the spot.

One of the first tractors made in Russia was the "Gnom". It develops 16-18 H.P. and has 3 wheels, the front wheel being the guiding-wheel and the two back ones the driving-wheels. It has a two-phase engine with two vertical cylinders and burns crude naphtha. It works like the Diesel but wthout compression. It is fired by high compression. In order to start the machine, compression is produced in one of the cylinders which is prevented from turning by means of a special valve. The revolution again becomes regular when the correct number of turns is obtained.

This tractor is suited to farms of 50-100 hectares; it can plough lightly, or harrow ½ hectare of land per hour. In autumn-ploughing with 3 plough bodies and a furrow 7 "zoll" deep, 3 hectares per 10 hours' day can be ploughed.

Next comes the "Saporoschetz" tractor made by the "Trust for the construction of agricultural machines of South Ukrania", which has

two fore guiding-wheels and one rear driving-wheel. It develops 12 H. P. It has a one-cylinder, two-phase engine also burning raw naphtha. This tractor is entirely made of Russian material. Its construction costs 1600 gold roubles (2 500 kg. material and 750 days of work). When tested, 2 hectares were ploughed to a depth of 7 " zoll " in 12 hours. It consumed 28 kg. of raw naphtha, or 4 kg. oil of naphtha, or 1.6 kg. petroleum and 151 litres of water per hectare.

Another tractor of Russian construction is that made at the Kolomna works in Moscow, which has a two-cylinder, two-phase engine burning crude oil. This tractor runs on 4 wheels and develops 25 H.P.

R. D.

422. Suitable Types of Ploughs for India.

COPLEY, H. (Agricultural Engineer, Central Provinces, Nagpur). *The Implement and Machinery Review*, Vol. 49, No. 585, pp. 1389-1390. London, 1924.

The author studies the question of ploughs in India under the following four heads: 1) economic aspect; 2) ploughs already on the Indian market; 3) whether European firms can turn out suitable ploughs for India; 4) type of plough suited to the agriculturist in India. Mention is made of the British-made ploughs that have given good results.

The author is of opinion that the limited use of ploughs is not so much due to the price of the implements, as to reasons of rural economy (parcelling out of holdings, lack of cattle). On the other hand, he thinks that the light ploughs chiefly used in India might be made in the country more cheaply than in Europe; they are now to be bought on the market at the price of 20 rupies. The disk plough is the best kind for India, but it must be simplified and adapted. In the central Provinces, a disk plough is now being turned out for 92 rupees and the price could be lowered if the machinery used in its construction were more up-to-date. R. D.

423. Automatic Plough.

Charrue à manœuvre automatique, *La Vie agricole et rurale*, Year 13, No. 8, pp. 122-123. Paris, 1924.

This implement is a plough with reverse, or shuttle action for working on the flat; it can be used as a one-share, or multiple-share plough according to the nature of the work. The back wheel revolves on a pivot, while the two front wheels are on an axle that unites them at the end of the slanting arms which support the upper part of the implement (see figure 63).

By means of a handle disengaging a bolt, the two large wheels are propelled forward to a limited extent by a screw regulating the depth of the ploughing. At the same time, the back wheel is raised by the action of a series of levers, while a notch prevents it turning on the pivot.

In order to remove the plough from the soil, another movement of the handle clamps together the wheels, axle and the slanting arms, so that they become a lever which raises the whole implement, while the back wheel descends into its position revolving all the time. By means of the pull exerted by the large wheels, and through the action of a gearing arrangement and claws, the bolt that holds in position the bodies of the plough shoots out of its shealth and the claws make these bodies revolve and bolt themselves on the opposite side.

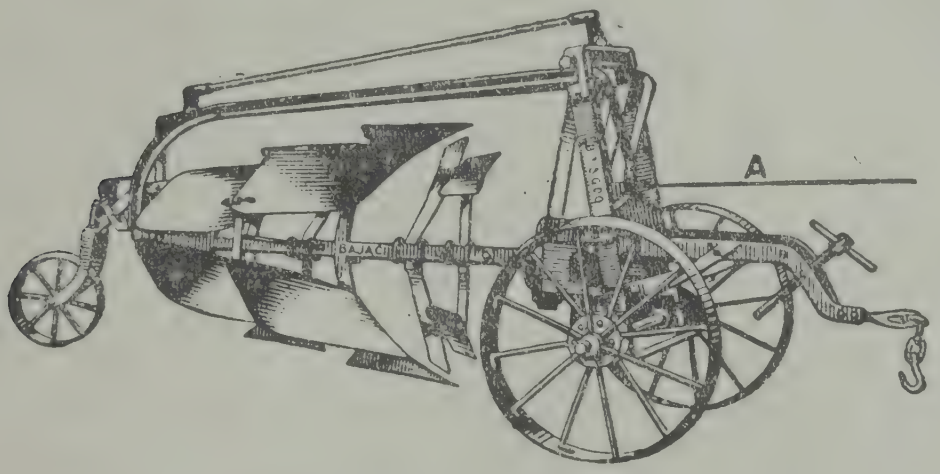

FIG. 63. — Bajac Phough with automatic adjustment.

Owing to the case with which the back wheel moves, the plough can turn in as short a space as the engine requires, and the driver controls all the operations of the plough.

The plough is made by the Bajac firm (France). R. D.

424. Net Cost of the Mechanical Cultivation of the Vine.

BUCHARD, P. Prix de revient de la culture mécanique de la vigne. *La Vie agricole et rurale*, Year 12, No. 22, pp. 374-375. Paris, 1923.

The " Office Agricole régional de l'Est " has had a number of comparative trials carried out near Epernay (France) in a vineyard where the vines were planted 1.20 m. apart, 1.40 m. being left between the rows. The apparatus was a 7HP. hoeing-machine of the G. L. I. type. The rows were 190 m. long and as the machine could only hoe a width of 0.85 m. it has to work twice down each row. The net cost of using this hoe was 560 francs per hectare. With a horse-hoe and hand-work the net cost was respectively 233 francs and 510 francs per hectare.

These figures show that hoeing with a tractor is expensive ; no doubt, the extra cost is to a large extent due to the imperfections of the present machines.

R. D.

425. **New Cotton Picking Machine** (1).

Banting announces new machine *Farm Implement News, The Tractor and Truck Review*, Vol. 45, No. 10, pp. 30-31, figs 3 Chicago, 1924

This machine (Banting Manufacturing Co., Toledo O., United States) works by suction. Each worker carries the head of an aspirator and places it against the bolls that are suitable for picking; the cotton is then conveyed to the cleaning chamber by the suction exerted by the vacuum pipes. Teeth placed along the pipes prevent foreign bodies from being sucked in and thus obstructing the passage.

The machine and all the mechanism are mounted on a self-propelling chassis handled by one man. 1 gallon of petrol is consumed per hour. The machine picks over 8 rows at a time, and during the tests, produced 2300 kg. of fibre in 10 hours of work, one mechanic and 8 collectors being employed. R. D.

426. **Mechanical Flax-Gathering-Trials.**

PASSELEGUE, G. (Chef de travaux de la Station d'essai de Machines). Essais d'arrachage mécanique du lin. *Journal d'Agriculture Pratique*. Year 89, No. 32, pp. 113-114. fig. 1. Paris, 1923.

A competition for mechanical flax-gatherers has been held at Wambrechies near Lille (France) in which the following three machines took part :

1) The Pusch-Tombyll gatherer (made by the U. A. S. Flax Harvesting Co.) fitted up on the spot (1).

2) Gatherer made by M. SOENENS of Iseghen (Belgium).

3) Gatherer made by M. ZÉMONT of Doullens (France) (1).

M. SOENENS's machine was the only one passed by the judge and it was awarded a prize.

This flax-gatherer is composed of two working pieces, one serving to pull up the flax and the other (situated at the rear of the machine) lifting the lodged crop in such a manner that it comes conveniently within the reach of the teeth of the machine. The first part consists of a large disk about 1 m. in diameter with a rim 0.10 m. high, covered with rubber to avoid injuring the fibres. This disk is inclined 45° to the horizontal, and the highest portion, which is in front, rotates on its own axis. Upon the disk, and covering about one third of its circumference, rests one of the straps of a rubber-belt passing over two pulleys and also over a roller that keeps apart the other strap. In turning, the disk catches hold of the flax stalks that lie between the rubber rim and the belt. As the disk is inclined at an angle of 45°, the stalks are pulled up and carried backwards, being dropped as soon as the belt leaves the disk.

In the rear of the machine, there is an arrangement for binding the stalks into bundles.

(1) See *R.* 1917, N. 179. (*Ed.*)

(1) See *Journal d'Agriculture Pratique* Year 88, Nos 31, 34 and 35. (*Ed.*)

The second set of working parts, which are intended for raising the more or less lodged crop, consists of horizontal teeth carried by two parallel chains : these teeth are arranged parallel to the forward movement. The shaft of the rear cog-wheels over which the chains run is higher than the front shaft, so that the lower strap in moving backwards, rises as it passes towards the rear.

Each tooth has a movement which is the result of two elementary movements, viz., a backward and rising movement (which depends on the lower portion of the chains that carry it) and a movement perpendicular to the preceding which causes the tooth to penetrate into the crop. The last movement is obtained by each tooth slipping along its axis within the two links that support it.

In short, each tooth penetrates progressively into the flax and raises it ; in this way, the lodged stems are thoroughly combed.

The machine can gather flax daily over an area of 2-3 hectares. It works over a width of 0.50 m. and is drawn by 2 horses. Although only an experimental model, this flax-gatherer worked well during the test; it did not clog, and left small flax and the weeds on the field.

R. D.

427. **Gas-Generators Running on Charcoal** (1).

PASSELEGUE, G. Gazogènes à charbon de bois. *Journal d'Agriculture Pratique*, Year 88, No. 1, pp. 10-12, fig. 1. Paris, 1924.

A description and report of the working of four types of gas-generators entered for the competition organised by the Comité Central de Culture Mécanique, which was held from September 20-22, 1923, at Essones (Seine-et-Oise, France).

R. D.

428. **Straw As a Fuel for Threshers.**

CHARBONNIER. Stroh als Brennstoff für Dresch-Lokomobilen. *Die Landmaschine*, Year 4, No. 1, pp. 3-4. Berlin, 1924.

On account of the conditions of the fuel and the straw markets, straw is beginning to be used in Germany for driving the engines of threshing machines. In this article, the various prices of straw are given and compared.

R. D.

(1) See *R.* 1923, No. 733. (*Ed.*)

AGRICULTURAL INDUSTRIES.

Plant Products.

429. Acidity of Wine Must.

De Astis, G. (Director of the R. Cantina sperimentale di Barletta). Gli acidi del mosto e del vino, pp. 458-810. Catania, 1924.

The opening chapters deal with the acidity of wine must from the scientific and industrial standpoint ; one chapter is reserved solely for the physico-chemical reactions. The second half deals with the individual acids and the various methods of combination: gaseous, volatile, fixed, organic, mineral.

The Oenological society in Italy has awarded a gold medal to the author in recognition of his services, in the practical application of science to wine making. F. D.

430. Sorghum Alcohol.

Trabut, L. Production de l'alcool industriel dans le Nord de l'Afrique. *Bulletin Agricole de l'Algérie-Tunisie-Maroc*, Year 30, No. 1, pp. 1-2. Algiers, 1924.

In North Africa, 300 quintals of sugar per hectare can easily be obtained from sugar sorghums, and under very favourable conditions, the yield may reach 800 quintals. On the other hand, sorghum alcohol has a slight flavour of rum and can be consumed as sugar cane alcohol. Since there is no difficulty in crushing the sorghum canes and extracting, fermenting and distilling them on the farm, this increase of the agricultural industries is highly advisable. Instead of extracting the juice from the canes, they can be cut up into small pieces and put with a certain amount of water into the fermentation vats. R. D.

431. Brandy from Apple Pomace (1).

Truelle, A. L'eau de vie de marcs de pommes. *Journal d'Agriculture Pratique*, Year 88, No. 1, pp. 12-14. Paris, 1924.

The only part of France where apple pomace is distilled is the East. The author describes the method of preserving and treating this residue. Attention is drawn to the fact that it only pays to use first pressure pomace containing at least 5 to 6 % of sugar. M. Warcollier says he has seen 3.25 to 4 litres of pure alcohol obtained per 100 kg. of pomace in cider-factories, but this return can only be expected from pomace that has been well conserved. R. D.

(1) See *R.* 1924, No. 182 (*Ed.*)

432. Sugar Industry in Brazil.

DA FONSECA HERMES JUNIOR, Y. S. O assucar como factor importante de la riqueza publica no Brazil. Rio de Janeiro. S. A. Litho-Typographia Fluminense, 1922, 8vo, pp. 1524.

The author discusses the reasons for the unprogressive nature of the sugar industry in Brazil under existing favourable conditions and suggests that legislative and administrative control be exercised.

The local consumption amounts to about 400 000 tons ; the quantity available for export varies considerably from year to year :— less than 5000 tons in 1912 ; 138 000 tons in 1917 ; 125 000 tons in 1921.

The " mascavo " and " demerara " sugars are exported to England and the United States ; the white sugar to Italy, Portugal and Paraguay.

In addition to the numerous small factories used only for local supplies, some 145 large factories are established in Brazil with complete equipment and 75 semi-complete. The author states the quality and quantity of cane utilised in each factory during pre-war years and compares the output with the principal factories in Cuba. The average price per kg. of white sugar in Brazil was 390 *reis* in 1914 and 1915 ; 950 *reis* in 1918 ; 910 *reis* in 1920 ; 630 *reis* in 1921. From the cane crushing mills in the country districts, 35-56 % juice is obtained ; some of the larger firms fitted up with improved machinery have extracted up to 80-83 %. The quantity of sugar obtained relative to the weight of the crushed cane is usually low. According to the inquiry made in 1919, out of 104 sugar factories, 5 % was supplied from 12 ; 5.1-6 % from 15 ; 6.1-7.9 % from 21 ; 7.1-8 % from 40 ; 8.1-9 % from 12 ; 9.1-10 % from 4.

The author closes by referring to the advantages of a large scale factory, the model equipment and the conditions favourable for the establishent of such a factory.

F. D.

433. Milling and Baking Experiments with American Wheat Varieties.

SHOLLENBERGER, J. H. and ALLEN CLARK, J. *United States Dept, of Agriculture, Department Bulletin*, No. 1183, pp. 1-92, tables, 73, figs. 23. Washington, D. C., 1924.

Results obtained from milling and baking experiments conducted by the U. S. Department of Agriculture with a view to the dissemination and enforcement of the official grain standards for wheat and the improvement of the wheat grown. Collaboration has been effected between plant breeder and market specialist, with the object of careful distribution of superior varieties of wheat. Experiments have been made to determine the comparative value of varieties classified according to the official grain standard and as regards factors of importance in the milling industry. Environmental factors are mentioned but special stress is laid on the qualities of certain varieties. Data refer to the hard, red, spring wheats, durum, hard and soft red winter wheats and the white wheats.

M. L. Y.

434. Bread made from Wheat and Manioc (1)

Pão Mixto. *Revista agricola, industrial e commercial Mineira.* Vol. I, Part 6, pp. 465-566. Bello Horizonte, 1923.

On the initiative of Señor Juscelino BARBOSA, Vice-President of the "Sociedade Mineira de Agricultura", bread-making trials with wheat-flour mixed with manioc-flour were carried out at the "Padaria Brasil" of Bello Horizonte (Minas Geraes). Similar tests were also made at São Paulo and Rio Janeiro; in all cases, the results were perfectly satisfactory.

The manioc must first be peeled and cut into very thin rounds; when the latter are quite dry, viz., have become brittle, they are ground, after which the flour is sifted in order to make it as fine as possible. The flour is of a pale yellow colour; it is mixed with wheat flour in the proportion of 40 %, and the mixture is made into bread in the usual manner. Beer yeast with high fermentation power should be used in preference to yeast made from acid dough.

Bread made from mixed wheat and manioc flours is quite different from bread made from pure wheaten flour, and in flavour and appearance is similar to rye-bread. F. D.

435. Bacterial Decomposition of Olives during Pickling.

CRUESS, W. V. and GUTHIER, E. H. *Agricultural Experiment Station, Berkeley, California, Bulletin* nº 368, pp. 1-15. Berkeley Ca., 1923.

The investigations reported were made during the olive pickling seasons, 1921-22, and 1922-23. The authors describe the nature of decomposition (fermentation, floating and softening) and the causes. Attention is drawn to the advisability of brine storage, and the disadvantage of using wash water above 60° F.

It appears also that pasteurisation at 212° F. or 190° F for 15 minutes or at 175-170° F. for 60 minutes checks fermentation long enough to permit the washing of the lye from the olive tissues. The application of 0.75 to 1 % lye for 23 hours checks the decomposition in mild cases sufficiently to complete the pickling process. Dilute lye and exposure to air after pasteurisation improves the colour of olives bleached by bacterial action.

In factories where the wash water is cold (40-50° F.) it is recommended that fermentation be arrested by the lye treatment. If the warmer water is available, 60° F. or above, pasteurisation will be necessary, cooled to room temperature; treated throughly with dilute lye; exposed 24 hours to the air to darken, and then rapidly washed free from the lye.

If bacterial decomposition has become throughly established in a factory, vats should be well sterilised with boiling water and the wash-

(1) See *B.* 1922, Nos. 1102 and 1369. (*Ed.*)

ing process hastened, using hot water (140° F.) to assist bleaching of lye from the olives. Storage for two days in brine before canning should be sufficient. M. L. Y.

436. **Observations on Micro-organisms Associated with Tea Fermentations.**

TUNSTALL, A. C. (Mycologist, Indian Tea Association). *Journal of the Indian Tea Association*, Year 1923, Part 4, pp. 126-131. Calcutta, 1924.

The author carried out a series of investigations in order to ascertain what effects were produced on the tea leaf by various organisms which are usually present during fermentation. Generally speaking, moulds and bacteria were found to be harmful, whereas yeasts produced a desirable aroma, and in some cases a difference in taste.

The enzymes produced in the leaf during withering and those produced by yeasts were isolated, and experiments indicated that the aroma of fermenting tea was due to the action of yeast and that the aroma was not developed unless the leaf has been withered or the mould enzyme added.

Some of the bacteria isolated from fermenting rooms were found to give characteristic taints to tea.

Tests were made to study the effect of inoculation with pure yeasts on tea-leaf from various factories. The time of fermentation of yeasted and unyeasted tea was approximately the same. No loss in tannin was noted even after 24 hours when air was excluded from the leaf, hence it was concluded that yeast does not act directly on the tannin.

The aroma produced by fermenting leaf varies from garden to garden and it is found possible by the use of yeast from a particular factory to reproduce the aroma characteristic of the fermenting leaf of that factory in another factory, on a different class of leaf, in another district. Not only has it been found possible to change the aroma of a tea, but also to change the flavour, and these alterations were found to be permanent.

Observations on the micro-organisms present on the leaf at different times of the year show that the quantity of yeast on the fresh leaf is at its maximum when the best quality teas are being made.

Yeast influences flavour and aroma; but cannot put pungency and strength into leaf which does not possess it already nor can it alter the appearance of a tea ; it does not add anything to the leaf but only acts on the substances present. W. S. G.

437. **Modern Methods of Food Conservation.**

SERGER, H. (Versuchsstation für di Konserven Industrie Braunschweig). Moderne Konserverungstechnik. *Die Umschau*, Year 27, Part 49, pp. 769-771. Frankfurt., a. M., 1923.

Scalding vegetables that are to be tinned causes a loss of nutritive substances and of bases which lessens the food and hygienic value of the canned produce. Herr A. HUCH has devised and patented the fol-

lowing method with the object of retaining the nutritive properties of tinned vegetables. The vegetables are put raw into the tin, water is then poured in till it reaches the height of one or two centimetres and the tin is placed in an open caldron, or autoclave, in order to sterilise the contents. In this way, the solvent action of the water is very weak, or may be practically reduced to *nil*, if an absorbent substance is placed at the bottom of the tin, or if the latter is provided with a perforated false bottom.

Eliminating the air from the tins containing animal, or vegetable, substances to be conserved, prevents the development of aerobic micro-organisms which are the chief factors inducing alterations in tinned products. There are many arrangements for getting rid of the air which can be used at home, or when the tinning is carried out on a small scale; for instance, the cover of the tin is perforated with a small hole allowing the escape of the air and the steam that arises as a result of heating; or the tin is soldered in a vacuum, or sterilised but so far, no method of expelling the air, or steam, was known that was applicable to tinning on a large industrial scale.

This was the object of the investigations made by Herr Huch in collaboration with the author. The expulsion of the air has also the advantage of allowing temperatures below 100° C. to be employed in sterilisation which insures a technical and hygienic improvement (less alteration of the vitamines) in the canned produce. F. D.

438 Studies made in Denmark upon the Average Composition of Cow's Milk, its Fat and Nitrogen Content.

I. — Anderson, A. C. and Laugmack, P. V. F. P. Undersøgelser over den Danske Koemoelks gennemsnitlige Sammensaetning 113te *Beretning fra Forsøgslaboratoriet*, udgivet af den Kgl. Veterinær-og Landbohøgskolos Laboratorium for Landøkonomiskefrosøg, pp. 1-37. 4 graphs. tables 12. Copenhagen, 1923.

II. — Andersen A. C. Om Bestemmelse af Fedt i Maelk. *Ibidem*, pp. 31-45, tables 2. Copenhagen, 1923.

III. — Andersen, A. C. and Jensen, B. N. Om Kvoelstofbestemmelser. *Ibidem*, pp. 38-102, fig. 1, tables 7. Copenhagen, 1923.

I. — Studies on the average composition of the milk of Danish cows. — The studies under consideration form part of a series of researches for which the Danish delegates made themselves responsible after a Conference held at Stockholm in 1918. The work was begun in the summer of 1919, and lasted for three years. The investigations extended to 34 dairies scattered throughout the country, these establishments undertook to forward once a month, for a period of three years, samples of fresh milk taken according to established rules so that they might regarded as representative of the average milk sent to the dairy on the day the sample was taken. The two bottles sent to each dairy contained an amount of potassium bichromate sufficient to insure the samples of milk containing 0.1 % of this salt when the bottles were full. At

first, the percentage of fat, protein, lactose, ash and water present in each sample was estimated, but as this work was more than the resources of the laboratory could cope with, the researches had to be confined to determining the amount of fat, protein and water present. The proportion of fat was found by the ROSE-GOTTLIEB method, while the protein was estimated by determining the total nitrogen by the KJELDAHL method and multiplying the result obtained by 6.37. The lactose was estimated by the reductase test, by means of Kjeldahl's tables after the protein, fat, and calcium salts had been previously extracted with copper sulphate, sodium hydrate and sodium fluoride as recommended by SCHEIBE. The ash content was ascertained by the calcination of 10 cc. of milk, the water percentage was found by desiccating the milk on pumice-stone in a water-bath.

The *chief results* of this work may be summarised as follows : the average fat content of the milk from Danish dairies is about 3.5 %. The average protein content for the three years may also be given, but the figure can only be approximate, since the proportion of protein has been increasing during the last five years. As we do not know whether this increase has stopped, we cannot take the figures obtained during the last year of the research as being normal. About the middle of November, however, the average protein content seemed to vary fairly constantly around 3.3 % ; it appears always to be lowest in the months of spring and summer during which growth is regularly most marked. The average content of dry matter freed from fat and protein remains about 5.7 % (the approximate percentage of lactose and ash being 4.8 and 0.8 respectively).

Since the amount of fat and of fat-free and protein-free dry matter remained practically unchanged during the years of the experiment, while the protein content increased, continually, it follows that the total dry matter percentage of the milk was rising. At the present time, the average amount of dry matter may be estimated at about 12.5 % (rather below than above this figure).

II. — ESTIMATION OF THE FAT CONTENT OF MILK. — It was formerly stated (in the 61st Report of the Laboratory), that neither formalin, not bichromate of potassium could prevent a considerable fall in the fat content (as compared with the initial fat percentage of certain milk samples that were tested by the SAL method, after having been allowed to stand for some time, although no such change was detected if the ordinary GERBER method (sulphuric acid fat-test) was employed. This phenomenon is to be explained as follows : during the time the milk is standing, some of the fat decomposes, with the formation of fatty acid and glycerine, in spite of the presence of formalin and potassium bichromate. In the case of the GERBER sulphuric acid method, this alteration is of less importance, as the acids remain unchanged, whereas in the SAL method, the sulphuric acid is replaced by a solution of alkaline salts, so that the fatty acids are transformed into soap and remain in the aqueous solution thus making the fat percentage registered too low. From his experiments on the different methods of fat-content determination (ROSE-

GOTTLIEB, SCHMIE-BOGDISYNARI-RATALAIT, here called the S. B. R. method), the pepsin-hydrochloric acid method and GROSSFELD's method), the author reached the following conclusion. As regards accuracy, none of the other methods can compare with the S. B. R. which should be adopted whenever the age, or character, of the milk give any reason to suppose that the easier Rose-Gottlieb method would be unlikely to succeed. The S. B. R. method has, however, the great disadvantage of producing coloured, dark spots when the milk is boiled; the colour passes into the ether benzine solution and imparts a dark hue to the fat. In order to avoid the difficulties inherent in the use of the best method, the author describes a process which he strongly recommends.

III. — NITROGEN DETERMINATION. — The question of the accuracy of the KJELDAHL method has given rise to much discussion, especially since different laboratories may have different ways of applying the said test. For this reason, it was considered advisable to take advantage of the opportunity offered by the above-mentioned analyses of milk to test the KJELDAHL method again. The chief objects of this study were:

1) To verify R. KOFOE's statement regarding the nitrogen lost during destruction.

2) To collect a larger supply of material, in order to show the importance of this source of error under different experimental conditions which are defined with more detail.

3) To vary systematically the conditions (time of boiling, temperature, catalysers), under which the destruction takes place, in order to discover which of these conditions induces the complete formation of ammonia in certain substances, or mixtures of substances.

4) To determine on the basis of the results obtained in 2 and 3 (which resembled experiments carried out by S. P. L. SØRENSEN and A. C. ANDERSEN on certain substances which were separated with difficulty), the conditions under which the destruction must take place, in order to insure the complete formation of ammonia accompanied by the minimum loss of nitrogen.

The *chief result* of this study on the sources of error in nitrogen determination may be expressed as follows:

If the destruction of the organic matter is brought about by a mixture composed of 20 cc. concentrated sulphuric acid, 10 gm. potassium sulphate, 1 gm. copper sulphate and 0.75 gm. sulphate of mercury, and if the mixture is allowed to boil gently and in a uniform manner (about 0.01 gm. of sulphite being added if necessary, so that the temperature is kept high without the mixture being over-heated), while the loss of sulphuric acid is limited as far as possible, all the protein-nitrogen can be converted into ammonia without any nitrogen being lost from the liberation of part of the ammonia produced. Boiling must be continued for 3-4 hours after a light-coloured (green) liquid is obtained. Some nitrogenous compounds that are very hard to separate may need boiling for an even longer time.

In the case of the analysis of chlorine compounds care must also be taken not to introduce the mercury salts before the hydrochloric acid

has been eliminated, otherwise the mercury will sublimate in the neck of the flask, or even in the air. The mercury must be deposited in the form of a sulphide before the distillation, but it is well to get rid of the excess alkaline sulphide, that has been added, by afterwards introducing some sulphate of copper.

No nitrite must be present in the caustic soda used in the distillation of the ammonia.

Should mercurial compounds be employed as catalysers, alembics of glass rather than copper should be used in the distillation. This process does not take longer if the washing apparatus recommended by KJELDAHL is replaced by that shown in this report and the same guarantee is obtained, at all events provided no zinc is added to facilitate boiling, which is not necessary, since pumice serves equally well.

If an experienced analyst follows these rules, he will probably find that only a few duplicate estimates occur per thousand. On comparing the results of several analyses made by different persons, much larger variations are to be expected.

(*Corr. Denmark*).

439. **Action of Rennet and of Heat on Milk.**

WRIGHT, N. C. (Institute for Research in Animal Nutrition, School of Agriculture, Cambridge). *The Biochemical Journal*, Vol. XVIII, No. 1, pp. 245-251, bibliography. Cambridge, 1924.

1) *Action of rennet on milk.* — After mentioning the different theories that have been held on this subject, the author describes the experiments he has made in trying to distinguish casein from caseinogen by means of the specific rotatory power of the two substances and their curves. Equal amounts of casein and caseinogen are dissolved in a N/2 solution of sodium hydrate ; the solutions are then left for a time at 37°C. and the optical rotation examined at intervals. The protein concentration is determined by the amount of nitrogen present and the specific rotation is calculated after each reading. Many estimations were made with different solutions, and in all cases, the results were found to agree well. Hence the two proteins may be considered as chemically identical. Two facts have, however, been brought forward against this view : 1) the different solubility of the caseinogen before and after the action of the rennet ; 2) the difference in the combining power of the two proteins. The first objection may be met by supposing the rennet to bring about a change in the colloidal condition of the caseinogen, so that the precipitation of the latter is facilitated by the presence of bivalent metal ions. As regards the second objection, it seems doubtful whether this chemical method by itself is sufficiently accurate to form a basis of differentiation, and it would appear better to rely upon the more accurate physical method. Arguments have also been brought forward in favour of the splitting of the caseinogen molecule by the rennet before it has been completely digested by the ordinary proteolytic enzymes. Such a hypothesis might agree with the equally probable explanation that rennet coagulates the casein

of milk in such a manner as to allow this protein to remain longer within the sphere of action of the digestive juices.

II. *Action of heat on milk.* — Various theories on this subject have been brought forward and the experiments made by the author were undertaken with a view to deciding the question. Four samples of milk previously centrifuged to remove the cream were taken and treated as follows: 1) not heated; 2) pasteurised at 60° C. for half-an-hour; 3) boiled for ½ hour in a reflux condenser; 4) placed for ½ hour in autoclave. After this, the different solutions were precipitated by acetic acid and the caseinogen separated and purified. The fine powder obtained is white in (1) and (2) slightly yellow in (3) and sandy yellow in (4). The respective solutions in Na OH are coloured in the first 2 cases, light-yellow, in (3), while in (4) it is reddish-brown and gelatinous at high concentration; this coloration cannot be removed by water, or any other ordinary solvent, or by dialysis.

Equal quantities were dissolved in an N/2 solution of sodium hydrate and the respective curves were studied. The results showed that within the limits given, heat produces no changes in the caseinogen molecule. The tendency to gelatination and the greater digestibility of the product when subjected to the action of the autoclave are due to the heat having modified the colloidal condition of the caseinogen. Boiled milk forms a lighter, finer coagulum in the stomach than raw milk. The author proved experimentally that the coloration of the product put into the autoclave is not due to the action of the heat on the caseinogen; the latter on precipitation appears coloured on account of the adsorption of the pigment, and not owing to any alteration in the molecule of caseinogen itself. This coloration is due to the caramelisation of the lactose and the reaction seems to be catalysed by the presence of the colloidal substratum of caseinogenate of calcium. P. D.

440 The Gerber Method Applied to Concentrated Milk.

STREMLER, J. Dosage de la matière grasse dans les laits concentrés par la methode Gerber. *Le Lait*, Year 4, Vol IV, No. 32, pp. 107-108. Lyons, 1924.

Estimating the fat content of concentrated milk by means of the GERBER method is a delicate operation as it is difficult to read the results correctly owing to the blackening of the fat column due to the action of the sulphuric acid on the sugar. In order to be able to get an accurate reading, it is necessary to mix throughly 4 parts of tepid water with 1 part condensed milk. For this purpose, an ordinary butyrometer and 1.820 acid is used, care being taken to centrifuge the mixture till a constant volume is obtained. The result of the reading is multiplied by 5. The best results are produced by an acid varying in density from 1.765-1.770; If only 50 % of water is mixed with 50 % of milk, the column of fat is not carbonised and is of a very light colour. The figures obtained should only be multiplied by 2 which diminishes the source of error. The fat column is longer and therefore easier to read. In the case of unsweetened con-

centrated milk, the milk and the water may be mixed in any proportion, the essential point under such conditions is to centrifuge the mixture at the rate of 1200 revolutions per minute in order that the resulting volume may be constant, since unsweetened milk is not homogenous, which renders the separation of the fat more difficult. P. D.

PLANT DISEASES (1).

Plant parasites.

441. Diseases of Glasshouse Plants.

BEWLEY, W. F. (D. Sc.) (Director of the Experimental and Research Station, Cheshunt.). Benn Bros. Ltd. London, 1923.

The main object of this book is to bring before growers of glasshouse plants the fundamental principles of disease control.

The opening chapter deals with the hygienic conditions of glasshouses in relation to health and disease, followed by a discussion on diseased conditions due to enviromental factors :— light, heat, humidity, soil, etc. Five chapters are reserved for a description of the chief diseases of glasshouse plants common to England. Structural details of the casual organisms have been purposely omitted as these do not concern the practical grower. The diseases described refer chiefly to the tomato, cucumber and melon, the carnation, rose, sweet pea, chrysanthemum, tulip, hyacinth, daffodil, etc.

The closing chapters deal with general reflections and considerations on disease treatment, followed by an appendix giving a list of the tomato diseases commonly found in England and those which occur occasionally, and also a selected bibliography. G. T.

442. Effect of Temperature on the Growth of *Helminthosporium Oryzae*, on Rice (2).

NISHIKADO, Y. *Annals of the Phytopathological Society of Japan*, Vol 1, No. 5, pp. 30-30. Tokyo, 1923.

According to the results obtained at the Ohara Institute for Agricultural Research, at Kurashiki, Okayania (Japan), the optimum temperature for the germination of the conidia is from 25°-30° C, at which temperature 70 % or more is obtainable.

(1) See also pp. 265, 269, 279, 304, 306, 316, and Nos. 336, 337, 341, 345, 346, 348, 349, 351, 374, 379, 455, 456, 457, 458, 459, 467, 478, 484, 511, 529, 556, 559, 560, 581, and 582 of this *Review*. (*Ed.*)

(2) See *R.* 1923, Nos. 310 and 806. (*Ed.*)

The minimum temperature for conidia germination is 2°C. The germ-tubes are spherical or elliptical, and decidedly nebulose but never linear as is generally the case.

The maximum temperature for conidia germination is 41°C. and the germ-tubes are also spherical or elliptical but smaller than those produced at 20°C. The temperature most favourable to mycelium growth is 27-30°. The maximum temperature for conidia formation is 35°-38°C. and the minimum 4°C.

Conidia produced at an optimum temperature are blunt club-shaped, and curve to one side; those formed at 5°C are cylindrical and straight and have fewer septa; those at 30°C are shorter and broader than those formed at 20°C.

Conidia formed at lower temperatures are darker in colour and lighter with rise in temperature. The thermal death point (in 10 minutes exposures) for the conidia is 50-51°C and for germinated conidia in hyphae, 48-50°C.

G. T.

443 ***Bacillus Croci*, n. sp. Cause of Bacterial Rot Disease of Saffrons, in Japan.**

MIZUSAWA, Y. *Annals of the Phytopathological Society of Japan.* Vol. I No. 5, pp. 1-12. Tokyo, 1923.

This bacterial disease of saffron (*Crocus sativus* L.) was observed for the first time in Japan in 1907 at Fuchû, Tokyo-Fu and Kozu, Kanagawa Ken, but did not attract much attention until 1917. In December 1918, the author noticed the disease at the Kanagawa Ken Agricultural Experiment Station. In January of the following year, the same disease was found to be prevalent at Okazaki.

When a tuber is infected, the leaves first lose their vigour, then wither and gradually turn yellow from the tip downward, this being noticeable in December. In January and February all the leaves become yellow and wrinkle. When the portion below ground was examined, the roots and tubers were found to be dark brown. In moist conditions, the tuber rots quickly, becomes juicy and yellowish-brown, but under dry conditions the rotted parts gradually dry up, as the texture is porous. This is the most common symptom of disease and where cultivated continuously in infected fields.

Occasionally, but less frequently, the infection occurs at a point of the sheath, followed by yellowing of the entire leaf. The infected leaves can easily be pulled off and the broken ends are brown and juicy. Such cases are confined to plantations of infected tubers in a healthy field.

Successful isolations were made of the casual organism and the pathogenetic nature proved; confirmed by subsequent tests. The author has described his new species as *Bacillus croci*. The organism is found on the rotted portion of the saffron plant and in the infected soil. The disease is mainly disseminated by transplanting diseased tubers.

Although no successful means of control has yet been found, a selection of healthy tubers and disinfection of seed tubers in lime water for half an hour is recommended.

G. T.

444. **Bacterial Blight of Hibiscus (*Bacterium Hibisci*) in Korea.**

NAKADA, N. and TAKIMOTO, K. *Annals of the Phytopatological Society of Japan*, Vol. 1, No. 5, pp. 13-19. Figs. 1. Tokyo, 1923.

Since 1913, an undetermined bacterial leaf-spot of *Hibiscus* has been under observation in Korea..

The disease attacks the cotyledons, especially of young leaves, after 2-3 leaves are formed, but is less virulent when the plants have fully developed. The first signs of disease are minute circular black patches which gradually increase in size and form circular or irregular outlines. Finally the margins become angular and limited by veins. The outer margin of the patches becomes whitish yellow or has a soaked appearance and when leaves are severely attacked the whole plant becomes blackened and dries up.

The casual organism has been termed *Bacterium Hibisci* n. sp. and has been successfully isolated and inoculated. Apparently the organism hibernates in the seed. Seeds were disinfected for 10 minutes with mercuric chloride (1 : 1000 water) or with hot water (55°C) and then sown. The plants were healthy but the control from untreated seeds showed 50 % diseased leaves.

An application of 5-5-50 Bordeaux, has proved very effective.

G. T.

Animal parasites.

445. **International Organisation for the Control of Locusts.**

(Organisation Internationale de la Lutte contre les sauterelles). Report of the Inspecteur de la défense des cultures à Alger, communicated by the Governor-General of Algeria to the President of the International Institute of Agriculture.

According to the Convention signed at Rome on the 31st October 1920, after the International Conference for the Organisation of Locust control, the " Service de la défense des cultures " has been charged to centralise all the information concerning the migrations of these Acridiidae.

Towards the end of 1923, the Government of French West Africa supplied the Bureau of Agricultural Intelligence at the International Institute of Agriculture with an interesting account dealing with the question. This has facilitated the study of locusts from the biological standpoint and has kept informed regularly the adhering States in North Africa and also the International Institute of Agriculture at Rome. In addition, the Anti-Locust Stations situated in the military territory on the oasis have furnished, in May 1923, valuable information concerning an invasion of " criquets pélerins " observed in the Ajjers section, especially at " Tiramait ", 40 km east of the Polignac fort. This invasion, more serious than any recorded in the same region during the last ten years, caused misgivings as to the possible spread into Algiers in the spring of 1924. Subsequent information furnished regularly by the above mentioned Stations has, however, dispelled this fear as regards Algeria, and influenced by the strong flights from the west it is considered probable

that the flight has been directed towards Tripolitania. This frontier is only some 60 km from Tiaret. As the Convention for locust control was only accepted by the Italian Government on the 15 October 1923, the "Service de la défense des cultures d'Algérie" has so far been unable to obtain further information as to the succeeding tracks followed. It is unfortunate that the definite adhesion of Italy and more recently of Egypt to the convention of October 31, 1920 has not permitted the following up of the returns.

440 Injuries Caused by Locusts in Hungary During the Years 1913-1923 (1).

Report drawn by M. J. JABLONOWSKI, Director General of the Hungarian Institutes of Agricultural Research, and transmitted by the Royal Hungarian Ministry of Agriculture to the International Institute of Agriculture.

Historical notes. Extension of infested territories and manner in which the locusts appeared. Biological data. — During the period 1913-1921, no noticeable injury was done by locusts in Hungary. The Moroccan cricket (*Dociostaurus maroccanus* Thumb.), however, made its appearance in 1914 shortly before the outbreak of the War, in Fászsag, viz, in the zone of Jásug, in the Commune of Jászkisér (Comitat of Jász-Nagykun-Szolnok), and in the following years it was also seen in the neighbouring Communes. The only means of control adopted was the attempt made by every one, each year, to prevent the insects doing any direct damage ; this state of affairs lasted during the War and throughout the period of successive internal disturbances. All this time, no other species of locust made its appearance in sufficient numbers to make it necessary again to have recourse to any of the old measures, or to devise modifications in them.

But in 1922, not only did *D. maroccanus* suddenly appear over large areas in the Alföld (Hungarian plain), but the Italian cricket (*Calliptamus italicus* [*Caloptenus italicus* Burm]), which does great havoc, also arrived and was still migrating in the month of August.

The pests were reported from the centre of Hungary, that is to say from the Comitats of Jász-Nagykun-Szolnok, Bihar, Hajdu, Békés and Csongrád. The fields of lucerne were, as a rule, attacked but though they were not much injured great fears were entertained for the next year. In 1922, it was impossible to control the locusts, for their presence was

(1) In the editing of this Report, the order of the subjects is that of the questionnaire sent in 1923, by the International Institute of Agriculture to the different countries of the world in order to collect information to serve as a basis for the Monograph published by the said Institute in 1926 under the title of : Locust Control in Different countries (La lutte contre les sauterelles dans les divers pays). The present Report, which refers to the years 1913-1923, gives the rest of the data furnished by the author, through the Hungarian Government in 1924 and already made use of by the Institute in the above-mentioned Monograph. (*Authors' Note*).

not reported until all the insects had assumed their winged form. Official note was, however, taken in July of the places selected for egg- laying (and which had only been traversed by the winged locusts) with the object of knowing where the pests might be expected and controlled in the following year. In 1923, however, the locusts appeared in such vast numbers as to exceed all expectations and all previous experience in Hungary during the last six or seven decades. In the second half of May, the daily press was the first to announce that in the Comitat of Vas (in the south-west extremity of Hungary) a locust properly so-called, viz. belonging to the family of the true *Locustidae* (*Acridiidae*) according to W. F. KIRBY, had unexpectedly made its appearance and had invaded vast areas and done great injury. An official enquiry was immediately opened on the spot and it was discovered that the Comitat in question had not suffered from any locust invasion of the character described, but that the swarms observed were composed of very large individuals of *Orphania denticauda* Charp, a member of the family of the *Phasgonuridae*. It was not a question of isolated scattered insects, but of really large swarms. *O. denticauda* is not rare in Hungary, indeed it often makes its appearance in astonishing numbers on damp areas covered with luxuriant vegetation. This was the case in Széklerland (" terra Sicularum ") and particularly in the Comitat of Csik, in Siebenbürgen, Erdély, Transylvania, where it is recorded that during the period 1849-1893, these destroyers of herbaceous plants invaded the damp meadows of the wooded zone for many successive years and then suddenly disappeared. In 1889, this large-bodied insect which is wholly defenceless since it possesses no wings, also appeared in the Comitat of Sopron, near the city of that name. The insects seen in 1923 at the time their presence was reported, at the end of May, were already fully-developed, and as the meadows had been mown, they came out of the places where they completed their metamorphosis and where they had remained concealed among the luxuriant grass and scattered in all directions seeking shelter. In the south-west about 15-20 km. from the city of Szombathely, the meadows, ploughed fields and fallow land, and even the roads, were full of these jumping or crawling insects and the people of the countryside were quite dismayed by the unusual phenomenon. No injury to vegetation could, however, be noticed in the zone over-run by these supposed locusts. The females only sought a place to lay their eggs, and therefore left untouched the green fields of rye, barley, potatoes, clover, etc., some of the insects found their way along the torrent Sorok to about ten or twelve little villages, while the rest followed the course of the river Rába northwards as far as the Commune of Ikervár. After about a week, they had all disappeared, the greater number, having been killed with shovels or spades, while the rest scattered over the meadows which are the natural places of their development.

As soon as the fears aroused by the appearance of *O. denticauda* had subsided, complaints began to arise against the Moroccan cricket (*D. maroccanus*) in the district which is permanently invaded by this species of locust (the Comitat of Jasz-Nagykun-Szolnok ; Jászkisér, Nagykörii, Törökszentmiklós ; the Comitat of Heves ; Pély, Tarnasrentmiklós)

where recourse was at once had to the steel brush [1] the implement most commonly used in the country for the control of locusts. Later, at the time when the locusts are winged, the presence of this species was reported from the Communes of Dévaványa (Comitat of Jasz-Nagykun-Szolnok); Sarud Uglónicz falva Karácsond, Tiszenána, Kiskóre, Porozsló (all in the Comitat of Békés), Hajdunánás (Comitat of Hajdu). But owing to the vast number of Italian crickets that appeared, the destruction of the insects had perforce to be abandoned for 1923.

Indeed, *C. italicus* appeared almost at the same time as *D. marocca-nus*, at first in places where from the experience of previous years it was not expected. Later, from the end of May scarcely a day passed without some Commune, or Communes, reporting the presence of bands of *C. italicus*. By the end of June, almost all the Hungarian district along the river Tisza was invaded from north to south. It is worthy of mention that in the communes where this locust was expected on the strength of the report made the previous year, the insect either never appeared, or arrived very late and in small numbers. At the end of July, nearly all of the country was invaded by the pest, only the part of Hungary lying to the right of the Danube remained practically immune, but even there, a certain amount of injury was done, although it could not be compared with the damage reported from the district watered by the Tisza. July proved an exceptionally hot dry month with the result that the whole Alföld was filled with winged individuals of *C. italicus*. The swarms were not migratory, but flew during the hot hours (from 10 a. m. to 1 or 2 p. m.) without any fixed direction, to-day to one point of the compass, tomorrow to another. This continued until the middle of August, while a few scattered individuals were observed even as late as the beginning of October at which date, *D. marocanus* was only represented by a few insects, the main band having disappeared by the end of July, or the commencement of August.

It is worthy of note that in the preceding years, *C. italicus* confined itself to the lucerne fields and poor permanent pasture-land, but in 1923, it changed it habits and visited the steep wide banks of the numerous overflow channels, haunting the enormous, interminable dykes along the Tisza, the slopes of the drainage basins of the zones chiefly threatened by inundation, and infesting the fields where it is impossible to kill the insects by means of the steel brush. When the winged bands were attacked, they took refuge in the plain to return once more and swarm upon the crops as soon as they felt the impetus of hunger. Further, *D. marocanus* in 1923, as in previous years, remained perfectly healthy until the date of its natural disappearance and was not attacked by any of its natural enemies. The stork, a bird, that generally visits the district in large flocks and destroys the bands of locusts was hardly seen, while only a limited number of *Coracias naevetanus* were observed here and there (for instance in the Large meadows of Csudahalia, near Gyoma). Of the Arthropods, only the

[1] For the description and method of using this implement, see International Institute of Agriculture: *La lutte contre les sauterelles dans les divers pays* (Control Carried on in Different Countries), pp. 132-133. (*Author's note*).

beetle *Epicauta verticalis* made its appearance and here again the number of individuals was very restricted. No other enemies of this locust were reported.

On the other hand, *C. italicus* was attacked even as early as 1922, by the well-known Entomophthoracea *Empusa Grylli* in the very regions, as far as could be ascertained, where it had appeared in preceding years. Probably this was the cause of the absence of these locusts throughout nearly the whole of 1923, in which year *Empusa Grylli* appeared for the first time exactly on July 1, a date when more than half the individuals of *C. italicus* are already provided with wings, although they cannot yet fly far. The stages infected by the fungus parasite were larvae, or nymphs, viz. always immature insects. The disease began to spread from the outset, and was observed in the northern part of the invaded district, that is to say on the northern region along both banks of the Tisza, where the locusts were present in the largest numbers.

D. maroccanus as usual attacked for the most part cereals (chiefly wheat) and other grain-bearing plants but did little injury except at Karácsond (Comitat of Heves), where it devoured nearly the whole crop of wheat growing on 1.15 hectares.

C. italicus, however, chiefly confined its attack as usual to crops with large tender leaves such as clover, lucerne, vetches, peas, pumpkins, artichokes, beans, broad beans, potatoes, etc. All the fields of these plants were devastated by the bands of young locusts. In 1923, as previously, the interesting observation was made that, in Hungary, *C. italicus* did not attack the vine. In the commune of Nagykörii (Comitat of Jász-Nagykun-Szolnok), *C. italicus* invaded in the first half of July, the vineyards that had been planted to fix the sand, thus giving rise to serious anxiety, but as the berries were still small, the plants were at once sprayed with a 20 % solution of copper arsenate (Uranian green). Unfortunately, the poison proved to have no effect, for after remaining in the vineyards for many days and flying at large among the vines, the locusts proceeded on their way quite safe and sound. The three species already mentioned do not, however, represent all the locusts that appeared. At the beginning of August, a large species of locust recalling the pests of past centuries were sent to the Roy. Entomological Station of Budapest. The insect proved to be *Locusta danica* L. (*Pachytylus danicus* Auriv., *Oedipoda migratoria* Burm, and " pro parte ", *Acrydium migratorium*, which although less known than the three preceding species, is still a great pest. *L. danica* was seen for the first time in the Commune of Nagydobos (Comitat of Szatmár) not far from the river Kraszna and the canal of the same name. It was, however, a question of only a few specimens ; 9-12 individuals being captured ; between Nagydobos and the neighbouring Communes 170-180 were caught. These individuals were the descendants of the once famous migratory swarms that earned for Hungary the name of the " Land of the Locust ". It should be noted that the same species of Locustidi were observed in the same neighbourhood (the Communes of Gebe, Nyircsaholy, Nyirmegyes and Vitka) in 1889. Although the insects were few in number, it was necessary to institute control measures again (the areas attacked were

ploughed the next autumn). This species of locust does not remain only as a vestige of past times in this part of Hungary, for it is found, although its representatives are very few in number, at Berettyoryrizalu (Comitat of Bihar) and at Nadudvar (Comitat of Hajdu). In the latter commune, the locusts were found along the bed of the river Radarcs which, in summer is almost dry. Only in these three centres of the development of the insect are the conditions of the ground almost identical. Nagybodos and its vicinity are hilly, Berettyonjfalu and Nadudwar are prototypes of the Hungarian plain (Alföld-plateau), but in all three localities there still exist muddy puddles left after draining the pools that formerly provided a breeding-ground for the locusts which multiplied there as they do today in the Dobrugia (the region of Danube delta). It is an interesting fact that in the three zones in question, both varieties of the species occur, the grass-green variety and the ash grey (*cinerascens* Fb.), the latter are a striking instance of adaptation of colour to the immediate environment (prevailing tint of soil and vegetation).

ACTUAL, OR PROBABLE, CONDITIONS FAVOURING LOCUST ATTACK. — The locust invasion ov 1923, and especially the appearance of *C. italicus* which before hast never been observed to occur in such large bands in Hungary, agree exactly with the suggestion already put forward by JABLONOWSKI (1). It is only now possible to see the effect that may be produced upon locust migration in Hungary by the regulation of the largest streams (the Tisza, etc.) and their tributaries, and the drainage of the perennial stagnant water pools, ponds, etc.). The almost complete disappearance of the largest representatives of the tribe (Locusta, *Pachytylus* spp.) and the rapid vanishing of the average-sized forms (*D. marocannus*, *C. italicus*, *Oedaleus nigrofasciatus* De Geer) confirm JABLONOWSKI'S theory in a striking manner. The change in hydrological conditions of the ground, and the effect thus produced upon the flora are the chief factors of this alteration in the fauna. A factor of secondary importance is, however, the present method of cultivation, for the wide areas of fallow land frequently met with in Hungary fifty or sixty years ago, are now cropped, while the methods, as well as the areas of cultivation, have greatly advanced since that date.

LOCUST CONTROL, ITS PRACTICAL RESULTS, PREDICTIONS FOR THE FUTURE. — The control of *C. italicus* has hitherto devolved upon the landowner who whenever it was necessary had recourse to straw and firing. The straw was strewn to the depth of about 3-4 inches over the ground (or plots of 60-80 m²), which the young, still unwinged locusts had invaded; as soon as the insects had crawled upon the straw, the latter was set fire to on every side. This operation was repeated on successive areas.

This method is very slow, and also is too costly, for today, even in Hungary, the value of straw is beginning to be realised.

In 1923, owing to the unexpected size and diffusion of the swarms

(1) Cf. INTERNATIONAL INSTITUTE OF AGRICULTURE: *La lutte contre les sauterelles dans les divers pays*, p. 72. (*Author's note*).

of locusts which threatened to invade the North-east third of the country, the Government was obliged to direct the control of these pests.

A steel brush can only be used to a very limited extent and only on land free from agricultural crops.

On the sides of the overflow basins and dykes it was necessary to begin the control operations on the appearance of the youngest locusts, before they were as large as a small ant. For this purpose, three or four boards were laid on the ground one beside the other. These boards were about 3-4 m. long and their united width amounted to 60-80 cm. They were first smeared with mineral tar of average density, and the young locusts on every side were carefully swept upon the board. One sweeping, or in rare cases, two successive sweepings, carried out in hot weather almost completely freed the ground from the insects. When the locusts are larger, however, they can jump off the boards. The above-mentioned method finds little favour with the operators, for not only is it expensive, but the labourers and their clothes get covered with tar which cannot be removed by washing. As this method could not be continued, it was resolved in 1923, to use sheets, or tents; in the manner described in Hungarian by the entomologist Emerich von Frivaldszky in 1848 as customary in the country within the memory of man.

Six or eight half-worn old sacks are sewn together to make a sheet, or tent, 8 m. long and 4-5 m. wide but having in the middle a slit leading into an ordinary bag. The locusts are carefully swept on to the sheet (as in the case of the boards), as it lies extended on the ground. As soon as the sheet is covered with locusts, the sides are suddenly raised, and the insects are shaken towards the centre of the sheet whence they fall into the sack and are trampled to death, after which they are thrown into another bag. A squadron of 18-20 young people (mostly school boys and girls), supplied with 8-10 sheets and working under competent direction can fill 15-18 sacks (viz. a cart-load) with small locusts in one day. The work was soon undertaken without pay but, this did not prove satisfactory, as it was slow and expensive, further it has a tendency to degenerate into a game in the absence of constant and severe supervision. One way of paying the workers would be to let them have the dead, dried locusts for a poultry-feed for which purpose these insects are most suitable.

The control of *C. italicus*, upon which together with the control of *D. maroccanus*, over 52 million crowns (exchange of June 1923) were expended in 1923, was a matter of dire necessity and hence carried out with the assistance of the State, but State aid cannot always be forthcoming on every similar occasion. How the control is to be regulated in future will be decided later.

It should be stated that recourse is also had in some Communes to certain apparatus that was employed in Hungary eighteen or twenty years ago when the second systematic campaign against *D. maroccanus* was initiated. These apparatus consisted of small linen bags 55-60 cm. long and tapering towards the mouth round which as sewn a wire as thick as a man's little finger. The wire is then bent into an oval 45

45 cm. long and 35 wide, and a handle about as long as that of a scythe is attached to the bag. Bands of 10-15 workers armed with these bags go to find the spots where the locusts are most numerous and catch the small insects that cannot yet do more than jump.

Satisfactory results in combating *D. marocanus* were obtained in 1923 as usual, except in those communes where the presence of the locust was not reported before the end of June, and where owing to the appearance of large bands of *C. italicus*, and to the very advanced season, (the beginning of harvest), it was impossible properly to begin and carry out the work of destruction.

On the other hand, very poor results were obtained from the campaign against *C. italicus*. The relatively large extent of the zone involved, the different methods of attack adopted, and the entire lack of any preparation for the control of this unexpected species of locust rendered abortive all the efforts made by the Hungarian Ministry of Finance to provide, at any sacrifice, the necessary means for combating the pest whenever it would be possible to obtain complete success.

Towards the end of June, indeed, it was necessary to renounce all hopes of completely destroying the Italian cricket and to be content with reducing the injury caused. This more modest aim was attained wherever it was feasible.

Since *D. marocanus* and *C. italicus* both continue to be more destructive, it is necessary to systematise the control of the former as well as of the latter, but hitherto no measures of combating *C. italicus* have been adopted in Hungary beyond advising large and small landowners, in their own interests, to destroy the pests in the most effective manner.

This control should, however, be rendered compulsory and practised under the supervision, and if necessary, the direction of the Authorities.

The expense of the work ought to be borne by each of the landowners interested, since also in the future the destruction of *C. italicus* will be a matter of local importance.

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Between 1912 and 1922, nothing was published in Hungary on the subject of locusts. In 1913, the following articles were printed.

JABLONOWSKI, J. Fenyegeto Sáska veszedelem (The Threatening Danger of Locusts) *Budapesti Hirlap* Budapest 1923. Year XLIII. No. 135. pp. 5-6.

IDEM. Az olasz sáska. (The Italian Cricket). *Közlek* Budapest, 1923. Year XXXIII, No. 51 (2793), p. 602.

IDEM. Az sáska termeszetes pusztulasa (The Natural Destruction of Locusts) *Ibidem*, No. 56 (2798) pp. 666-667.

447. Locusts in Bulgaria during 1923.

Communication made by the Ministry of Agriculture and of the Royal Domains of Bulgaria to the International Institute of Agriculture.

According to the information obtained by the central Agricultural Experiment Institute at Sofia, the number of locusts reported during

1923 in Bulgaria was not large enough to warrant organising a campaign for their control.

Locusts (probably belonging to the species *Caloptenus italicus* L.), made their appearance only in the vicinity of Jambol, in the South-east of Bulgaria, where they caused but little injury to the crops they attacked in five, or six, villages.

Gryllus campestris L. was found more frequently, during the same year, in the north-west of Bulgaria, but it did no appreciable harm to the crops. G. T.

448. **" Formiga cuyabana " (*Prenolepis fulva*) in the control of " formiga sauva " *(Atta sexdens)* in the State of Minas Geraes (Brazil).**

Formigas cuyabanas. *Revista Agricola, Industrial e Commercial Mineira*, Vol. I, Pt. III, p. 205. Bello Horizonte, 1923.

The municipality of the State of Minas Geraes (Brazil) has requested the Government to encourage the propagation of " formiga cuyabana " (*Prenolepis fulva* Mayr) in the agricultural areas.

There is a certain difference of opinion as to the usefulness of this insect ; some support the theory that formicide is the more effective form of control of *Atta sexdens* (1) and claim that *Pr. fulva* is of too voracious a type of insect ; others consider that *Pr. fulva* does even more damage than *A. sexdens* and contest its value as a parasite in the control of " formiga sauva ".

With a view to clearing up the question, which is of economic interest both in the State of Minas Geraes and the entire country, the " Sociedade Mineira de Agricultura " with headquarters at Bello Horizonte, has issued a detailed questionnaire to be sent to agriculturists and the replies should provide useful information concerning this problem to be dealt with by a special Committee of technologists. G. T.

449. **Arsenic Supplies and Value in the Control of Cotton Boll Weevil.**

AMBRUSTER H. W. Arsenic, Calcium Arsenate and Boll Weevil (14 Articles and Addresses), pp. 42, figs. 2. Barr-Erhardt Press. Inc. 205 West 19th Street, New York, 1923. Price 50 cents.

Although this publication should not be considered as a comprehensive technical treatise or as a carefully prepared economic thesis, Mr. AMBRUSTER has rendered a distinct service in the collection of recent articles which include most of the phases of general interest that affect and control the arsenic, calcium arsenate and boll weevil problem.

Amongst all the other forms of poisonous compounds that have been tried, it is an undisputed fact that the calcium arsenate spray has given the most effective results, and the proper application of this insecticide is essential. This spray has hitherto not been adopted universally owing

(1) See *R.* 1923, p. 1147. (*Ed.*)

to the high cost and the difficulties in securing an adequate supply, in addition to the frequent lack of knowledge on the part of many planters. The specifications recommended for the dusting material (*Manufacturers Record*, June 29, 1922) which must be complied with and guaranteed on the makers label, are as follows: 40 % arsenic pentoxide, maximum 0.75 % water soluble arsenic pentoxide and density 80-100 cub. inches per pound.

Government experimenters (U. S.) have devised a simple testing apparatus for determining the density, most desirable for the effective application to the plant. This should help to overcome the difficulties of standardisation for those interested in production, sale, inspection or use of the product.

Quite recently two important improvements have been made in the manufacture of this insecticide, one in the acid production and the other in reduction of the moist calcium arsenate to a commercial dry powder. Observations have been made as to the effect of these various forms of production on the same plant, and old and new types compared. The value of the improved methods were evident, and the superior quality of both the arsenic acid and the finished insecticide in addition to the labor saving advantages. Details of these improved methods are given in the article entitled "Calcium Arsenate Manufacture" (pp. 14-17).

A boll weevil control campaign has been organised by the American Cotton Association which aims at the co-ordination of the efforts of each existing agency and the development of all possible promising means of control of this pest. This is comprehensively reviewed under the heading of "Cotton, a World Asset, endangered by the Boll Weevil" (p. 18).

Mr. AMBRUSTER has also included in his collection a series of articles on: Arsenic supplies and the tariff; lime-making for calcium arsenate; arsenate shortage a serious reality; arsenic and calcium arsenate supply; arsenic acid plant with nitric recovery towers; the arsenic situation; a brief for higher arsenic.

M. L. Y.

459. The Crustacean *Apus cancriformis*, Injurious to Rice in Spain.

FONT I MORA, K. Un destructor de plantelas de Arroz El *Apus cancriformis* Schäff. *Boletin de la Real Sociedad Española de Historia Natural*, Vol. XXIII, No. 7, pp. 313-314. Madrid, 1923.

During 1923, *Apus cancriformis* Schäff. increased enormously in the rice seed-plots in the district of Valencia, where this crustacean is known to the agriculturists under the popular name of "tortugueta". By means of its appendages, this arthropod creates a vortex in the water in order to bring the small organic particles on which it feeds within reach of its mouth. This movement of the water separates the soil from the roots of the rice seedlings with the result that they perish. The injury thus caused to the seed-beds during April and May is considerable.

Control experiments have shown that *A. cancriformis* is destroyed in 4 minutes by a 1 % solution of sodium cyanide, by a 1 % solution of hypochlorite of calcium in 3 minutes, by 5 % ammonium chloride in 5 mi-

nutes, by 5 % ammonium sulphate in 10 minutes; by 5 % "zotal" in 20 minutes, and by 1 % permanganate of potassium in 20 minutes.

For every "hanegada" (1 hanegada = 847 m²), 500 to 1000 gm. of sodium cyanide are needed. The level of the water in the nursery is raised, and the cyanide enclosed in a fine cloth is so arranged in front of the inflow water-pipe that all the water is obliged to pass through the cyanide. If the crustaceans are then observed, they first show signs of great agitation and subsequently come to the surface to die. Any undissolved cyanide is then removed and the operation is finished.

Among the substances used in the experiment, ammonium sulphate is the best, especially since it also acts as a fertiliser. If mother lye-water from gas-scrubbers can be obtained, it may be used instead of ammonium chloride.

The agriculturist should notice which fields are invaded by the crustacean, in order to apply calcium cyanide the following year and be able to decide whether it is not well to spread some of the fertiliser early before sowing the rice. Where the ground has already been invaded, it is as well to dig it over-flow-channel into which the superfluous water can drain off, carrying with it the crustaceans that can then be destroyed by means of one of the substances mentioned above. G. T.

451. ***Hylobius perforatus*, a Coleopteron Injurious to the Olive Tree in Japan.**

POUTIERS R. Un ennemi de l'olivier an Japon, *Hylobius perforatus* Roel. (*Col. Curculionidae*). *Bulletin de la Société entomologique de France*, No. 3, pp. 47-48. Paris, 1924.

At the Takamatsu Agricultural Station, and other suitable places, attempts have been made for some years to acclimatise the olive in Japan. but all efforts have so far proved unavailing on account of a beetle that seriously attacks the young trees, and in the words of the Director of the above Station, "destroys all the olive-trees of the plantation".

The insect, which is unknown to Japanese entomologists, has recently been identified as *Hylobius perforatus* Roel. by HUSTACHE who describes it as belonging to Japan, but gives no data respecting its life-history.

The larva of the Curculionid in question excavates galleries of increasing size running from the phloeum to the sapwood thus completely encircling the young olive-branches, which wither and die. No information is yet to hand respecting the injuries caused by the adult beetle. G. T.

452. **The Grey Scale Insect of the Pear-Tree *(Epidiaspis pyricola)* in Uruguay.**

TRUJILLO PELUFFO, A. Nueva cochinilla para el país. *República Oriental del Uruguay. Ministerio de Industrias. Defensa Agrícola. Boletín mensual*, Year IV, Nos. 3-4, pp. 39-40, fig. 1. Montevideo, 1923.

Epidiaspis pyricola del Guercio was collected for the first time in Uruguay during February 1923 from pear-trees growing in the vicinity of Sayago (Department of Montevideo).

The trees attacked by the scale-insect were in a bad state ; at the above-mentioned time most of their leaves had already fallen while the fruits were half-grown.

So far, *E. pyricola* does not appear to be widely diffused in Uruguay.

G. T.

453. **The Mulberry Scale *(Diaspis pentagona)* in the Maritimes Alpes, France** (1).

SAGNIER, H. La cochenille du Mûrier. *Journal d'Agriculture Pratique*, Vol. I, No. 10, p. 186. Paris, 1924.

The mulberry scale (*Diaspis pentagona*) was observed recently in Saint-Laurent du Var (Maritime Alps). According to the decree established by the Ministry of Agriculture in February 4, 1924, it was prohibited to introduce branches, and cuttings coming from prunings of trees, bushes or other woody plants attacked by scale : such material should be burnt immediately ***in situ***.

G. T.

(1) See *R.* 1919, No. 408 ; *R.* 1920, No. 602. (*Ed.*)

CURRENT NOTICES

Legislative and Administrative Measures.

454. **Brazil.** *Decree of December 31, 1923 approving the Regulations of the National Department of Public Health.* — These regulations, which are very detailed, refer to the prevention, treatment and notification of diseases ; sanitary work, hygiene, the preparation and sale of foods and medicines. They establish (paragraph VI) the standard of purity for cereals and flour, alimentary pastes, bread, biscuits, jams, jellies, sugar and sweets (a list is given of the colouring matters that may be used for these products), fruit juices and syrups, lemonades and similar beverages, sherbet, water, honey, condiments, oils and fats, coffee, tea, maté, cocoa and chocolate, wines, beer, brandies, and liqueurs, vinegar and milk. (*Diario official*, February 1, 1924).

455. **China.** *Order No. 309, May 5, 1923, of the Ministry of Agriculture and Commerce giving the Regulations for the Distribution of the Services of the Ministry and Commerce.* — The Ministry is composed of : the Council, the Office of Technical Inspection ; the Secretariat, the Office of General Affairs and of the General Management : — agriculture, and forests ; industry and commerce ; fisheries and pastures. The General Management of Agriculture is divided into four sections and its sphere of work includes : the protection, control, encouragement and teaching of agriculture ; agricultural societies and other agricultural bodies ; agricultural production and silk production ; the tea and cotton industries ; the sugar industry ; Meteorological Stations, Agricultural Experiment Stations ; rectification of holdings and irrigation ; the International Institute of Agriculture at Rome and the study of agriculture of foreign countries (section I) ; the supervision, protection and encouragement of sylviculture, instruction in forestry ; the State woods and forest reserves ; forestry products ; the management of the finances of the State forests (section II) ; enquiries respecting uncultivated land, the management of the State uncultivated land, home colonisation ; emigration for the purpose of colonisation, and the military colonisation of the frontier provinces (section III) ; the improvement of agricultural work, of horticulture and silk-worm-rearing, of the tea, cotton and sugar industries ; climatological observations ; questions respecting injury done to agricultural crops, silk-worm rearing and mulberry-tree cultivation by natural calamities, diseases and insects ; schemes for the rectification of holdings and for irrigation ; fertilisers and agricultural implements ; schemes relating to the fields and the establishments for working up agricultural

and forestry products ; the chemical examination of soil, fertilisers and agricultural and forestry products ; schemes for working the State, or reserved woods ; land-surveying and topography applied to uncultivated land and to forests, forest management ; public works and buildings in colonisation districts ; schemes respecting saw mills and timber stores (section IV).

The General Direction of fisheries and pastures has the following work : the encouragement, and control, of all instruction, statistics and societies etc. relating to fisheries (section I) ; the delimitation of pastures, the control of public bodies interested in fish breeding and in grazing-grounds ; the encouragement of, and instruction in, stock-breeding, the inspection of the products of stock breeding, the control of markets and shooting (section II) ; the propagation of the aquatic fauna and flora ; the improvement of fishing and fishery products ; and of the management of streams, ponds, etc. ; the analysis and estimation of the aquatic fauna and flora ; the improvement of rural live-stock, veterinary police measures ; inspection of pure-bred stock ; enquiries into epizootic diseases ; the preparation and testing of immunising serums ; veterinary and farrier's work. (*International Institute of Agriculture Textes legislatifs*, No. 49. 1923).

Provisions concerning Agricultural Societies. — 1) The report in which the Minister of Agriculture and Commerce submitted to the President of the Republic the amended resolutions dealing with Agricultural Societies and the provisions for the application of the said resolutions. (May 21, 1923) ; 2) Amended regulations referring to Agricultural Associations (May 19, 1923) ; 3) Order of the Ministry of Agriculture and Commerce containing provisions for the application of the regulations referring to Agricultural Associations (May 19, 1923). (*Ibidem*, No. 51).

Order No. 350, *May* 12, 1923, *containing the Regulations for the Control of Diseases and Parasitic Insects of Agricultural Crops.* — It has been rendered compulsory for the agricultural bodies of every province to adopt the most suitable measures for carrying out studies and research respecting :— the injuries done to agricultural crops by cryptogamic diseases and insects ; easily procurable anti-cryptogamic mixtures and fungicides ; the propagation and protection of useful birds and insects ; making collections of parasitic cryptogams, injurious insects and useful insects (Art. 2). The agricultural bodies of every province should devise means to prevent injuries from diseases and insects and make this control the subject of a report to the local authorities who shall inform the public thereof (Art. 3). When it is necessary, the Head of the local Authorities shall order the population :— to carry out in common the preventive and control measures advised by the agricultural bodies ; to collect by subscription the funds necessary and above those allocated for these purposes out of the public funds of the district he has the right of inspecting and requisitioning labour (Art. 4-5). Imported plants and seeds must be inspected and disinfected on their arrival in China (Art. 10). Methods of prevention and control that have proved efficacious must be widely diffused (Art. 11). The present regulations shall also apply to parasites and enemies other than cryptogams and insects. (*Ibidem*, No. 50).

456. **Spain.** *Royal Decree* (*March* 12, 1924) *for the Control of the Enemies and Diseases of Forest Trees.* — The "Ministerio de Fomento", in conjunction with the "Servicio de Estudio y Extinción de Plagas Forestales", shall arrange

for : *a*) the drawing up, or amendment, of the list of forest foes and parasites, mentioning the species attached and the places where they grow : *b*) the adoption of prophylactic measures (the prohibition and regulation of the importation circulation, and sale of seeds, plants, timber, etc. coming from zones known to be infected) and keeping in mind the obligations assumed in the international Conventions to which Spain may have taken part ; *c*) the disinfection and control measures to be adopted in the case of every disease and pest ; *d*) the compulsory application by the proprietors of the treatment they consider most effectual against such insects and enemies of forest trees as threaten to spread the contagion beyond the boundaries of their property (Art. 1).

The "Ayuntamientos" (Municipal Councils) shall be obliged to notify to the "Dirección general de Agricultura y Montes" any pest, or disease, occurring in the woods of the municipal territory (Art. 2). The "Ministerio de Fomento" shall undertake at its own expense to direct the control work whenever it thinks it necessary, either on account of the character, or the importance, of the pest. It may also contribute to the expense of carrying out the treatments effected by the municipalities and by private individuals to the extent of providing the necessary materials. It shall continue to assist in the systematic study of the pests attacking forest trees by popularising the treatments that this study has proved to be effective (Art. 3).

The owners of woods that have been attacked by pests, or contagious diseases, may form Associations for protection on the request of three-quarters of the owners, or of the proprietors of more than one half ot the area to which the protection is to extend. The formation of such associations may be rendered compulsory by the "Ministerio de Fomento" (Art. 4)

The "Ministerio de Fomento" shall issue, in the case of every enemy, or disease that appears, a special Royal Order fixing the best time and methods of the control of the said pest or disease (Art. 6). (*Gaceta de Madrid*, March 13, 1924).

The Royal Decree (*March* 13, 1924) *requiring the "Ministerio de Fomento" ceed to the Eradication of "lagarta peluda"* (*Lymantria dispar*) *which is attacking the Oak-Woods of Villanueva de Cordoba and of its Vicinity*, has been issued in accordance with Art. 6 of the preceding decree. A mixture of tar and petroleum has been selected for application in the autumn-winter campaign for the control of the "plaston" (eggs). The said campaign shall be continued from August 15 to the 1 of March following, until the zone in question is declared free from the pest. Independently of the said campaign, another campaign shall be undertaken every year, in April for the control of the young larvae that have just hatched out and are infesting the hedges or other boundaries between the estates, since these caterpillars cannot be destroyed by the previously mentioned campaign. (*Ibidem*, March 15, 1924).

457. **France.** *Decree March* 24, 1924, *Instituting a Register-Catalogue of the Pedigree Books of French Breeds of Live-Stock, to be followed by an Order fixing the Conditions of Entry on the said Register Catalogue.* — This Decree gives an extract from the report of the Session held in March 18, 1924, by the superior Commission of Pedigree-Books which extract gives the approved standard for any given breed of animal. It is necessary to avoid mentioning characters that apply equally well to all fairly well-shaped animals of the same

species and only to give the typical points which are really characteristic of the breed and represent the type and its aptitudes. It is advised that a description should further be given of : 1) the disqualifications ; 2) the special characters required in breeding-animals. (*Bulletin de l'Office des Renseignements agricoles*. Paris, April 1924).

Order (*March* 24, 1924) *distributing the Horticultural Establishments and the Establishments for Agricultural Products of Plant Origin amongst the various Phytopathological " Arrondissements "* (*Journal officiel*, March 25, 1924).

Agriculture in Different Countries.

458. **Development of Tropical Agriculture.** — The establishment of the Imperial College of Tropical Agriculture indicates a marked step in the advancement of tropical agricultural development. The fact that researches of men of science have saved the agriculturist and the community immense sums of money, has already been proved in Europe, United States, India and other parts of the world. Where the ravages of diseases and insect pests have hitherto been responsible for severe crop losses. It is evident that science is slowly gaining control over the devastative forces of nature. But applied to tropical agriculture, what does this demand ? — the training not only of specialist and research workers and the man who will keep the crops free from disease, but also of students along lines as summed up in the Prospectus of the Imperial College : " the object of the College is to afford general instruction in tropical agriculture, to give opportunities for thorough training in the science and practice of the subject, to those students intending to become tropical planters, investigators or experts in different branches of agricultural science or technology, and at the same time to provide facilities for the study of tropical agricultural subjects on the part of graduates from other Universities and colleges who desire to acquire knowledge of these subjects in tropical surroundings ".

This is essentially an educational as well as a research Institute, and the permanent building will be equipped as a " model home of Science " on a site of 84 acres with botanical, mycological, entomological and chemical laboratories attached. On the site in the grounds, a model sugar factory will be built during the summer, thanks to the collaboration of the British sugar machinery manufacturers.

Trinidad has been selected for reason of the fertile soil, very varied in nature and therefore suitable for crops of every kind of tropical produce.

The interest which has been aroused in other tropical countries is evident from the fact that the Rhodes Trustees which represent Canada, Australia and South Africa, have given a generous contribution, and support has also been urged in Sierra Leone and Nigeria. As regards European affiliation, the fact that the British Cotton Growing Association is making the Imperial College, the headquarters for training their experts and has free studentships at their disposal, speaks for itself.

It is considered that " a young man trained at the College for 3 years followed by 2 years on a plantation, will prove more efficient than one who has spent 15 years on a plantation alone .. It might be worth while for some of

those responsible for the management of estates to visit the College to acquaint themselves with the latest news on fertilisers and other matters of importance ".

It will be by its success in promoting the welfare of agriculture and of the industries that arise directly out of it that the College will be judged. (Abstract from address delivered by Sir Arthur Shipley in connection with the Imperial College of Tropical Agriculture, Trinidad (1), Jan. 8, 1924).

NOTE. — The courses of agritulture have been arranged with a view to affording broad general knowledge of the principles of crop production, including the preparation and tilling of fhe land, planting, reaping and preparation of the principal tropical crops, control of diseases and pests, care maintenance of farm animals, farm implements, and related subjects. (Prospectus, Imperial College of Tropical Agriculture. St. Augustine, Trinidad. 1923. (London Offices, 14 Trinity Square. London E C 3).

459. *Treatise on Modern Agriculture.* — As Prof. G. RAINERI (ex-Minister of Agriculture) states in the introduction, the volume under examination " sets forth the scientific practices that are based on the proved results of modern experimental work. In this book are to be found : the details of applied mechanics which from its rapid progress of recent years has brought about one of the most effective innovations in the cultivation of the soil ; the details connected with soil improvement by means of the application of artificial manures and even the principles of genetics. This book is of an essentially practical character, as the author states, and is intended for agriculturists much more than for schools.

The crops considered are : wheat, rye, barley, oats, rice, maize, sorghum, forages, meadows and pastures of red clover, ladin (Tyrolese) clover, hybrid clover, lucerne, lupins, lotus and broom, wild lupin, sulla, herbs, hemp, flax, tobacco, mint, sugar-beets, potatoes, tomatoes, rice, rape and mustard.

In the case of every plant are considered : its botanical characters and varieties, the climatic and soil it requires, its place in rotation, the preparation of the ground, manuring, seeding and seeds, methods of sowing, cultural operations, harvesting, unfavourable conditions, vegetable and animal parasites. The technique of the cultural operations is considered in relation to the differrent climatic conditions. In the chapter dealing with meadow cultivation, the Cremascan silo is described and reference is made to experiments in feeding dairy cows on silage hay. (BASSI E. *Agricoltura d'oggi*, pp. VIII + 583. Piacenza. C. Tarantola, 1924).

460. *Worlds' Wheat Production.* — In comparing the unit wheat production of the different countries of the world, the proportion of the area under wheat must be taken into consideration. Industrial countries that obtain foreign wheat at low cost (England, Denmark, Belgium and Germany) sow wheat only on a small proportion of their area and select on the most suitable soils where the conditions are favourable to high crop yield. On the other hand, protectionist countries, where industry has made less progress, sow wheat everywhere, even on poor land. If they were to concentrate wheat-growing on intensively cultivated soil, these countries would obtain the same unit production as the other but they would be obliged to purchase most of the wheat consumed.

(1) See also *R.* 1922, No. 369, and *R.* 1913, p. 253 and p. 801. (*Ed.*)

In countries where wheat is largely cultivated, the crops have not increased *pari passu* with the demands. This discrepancy is not so much due to the increased population, as to the continually rising consumption per head owing to the higher standard of living and the greater wealth; with the growth of the urban and industrial population wheat is being substituted, to an ever increasing extent, for the inferior cereals (rye, maize, etc). (R. MUSSET, *Comptes rendus de l'Académie d'Agriculture de France*, Séance of January 16, 1923).

461. **French West Africa.** — *Colonisation in the Kameroons.* — Many data on this subject are given by the work entitled: "Commissariat de la République Française au Cameroun. Guide de la Colonisation au Cameroun" (pp. 165. diagr. 3, maps 4, 39 photographs. Larose, Paris, 1923) which includes the following chapters: Physical geography — History — Human geography — How to travel in the Kamerun — Means of communication and modes of transport — Administrative organisation — Life in Kamerun — Land and mining legislation — Agriculture — Industry, and commerce — Customs regulations — Administrative appointments.

462. **Argentina.** *The Wool Position.* — The feature of the Argentine wool year 1922-23 was the keen demand from all centres, and that practically no stocks of any grade were left in the country at the end of the season (30th September). Only two years ago there were large accumulations of unsold wool for which there was practically no demand at any price.

During the past three years (ending 30th September) exports of wool amounted to 314 905 bales (each of about 925 lbs) in 1920-21; 474 776 bales in 1921-22 and 358 786 bales in 1922-23. In the two former years Germany was the largest individual buyer, but last year the United States took first place, with about 90 000 bales, closely followed by France and Germany, the United Kingdom coming next with a little more than 50 000.

All indications point to remunerative prices for the 1923-24 clip, and it is estimated that there will be a shortage of about 20 per cent. in production, as compared with 1922-23, due to bad weather and heavy snow in several provinces and also to reckless slaughtering of animals throughout the country for meat trade. The most recent census, in fact, shows that on 31st December 1922, the number of sheep in the Argentine Republic was 30 670 000 as compared with 43 million at the previous enumeration (1914) and 75 million in 1895. (*The Agricultural Market Report*, Vol. XXI, No. 13, p. 2. London, 1924).

463. **Australia.** *New Irrigation Works.* — The irrigation works on the Murray River, now under construction, will probably involve an expenditure of ten million pounds. The principal work now engaging the attention of the constructing authorities, New South Wales and Victoria, is the Hume reservoir situated half a mile below the point where the Mitta Mitta River joins the Murray. The embankment will be 3600 feet in length: the water depth will be 73 ft on the Victorian side, increased to 94 ft in the river channel. The storage will rank amongst one of the greatest in the world.

Two large storage basins will be constructed, and when completed the depth of the river will be maintained by a series of 35 weirs and locks, so that the full length of the stream may be open for navigation throughout the year. This will cheapen transport to the coast of products intended for

shipment overseas. (*Journal of Royal Society of Arts*, Vol. LXXII, No. 3720, pp. 270-271. London, 1924).

464. **Brazil.** *Onion-Growing in Rio Grande do Sul.* — About twenty years ago, onion-growing was begun at Arzail (Municipio di Rio Grande) on account of the large sums it brings in. At the present time, there are 2100 hectares under onions ; 21 00 tons are produced, most of the crop being exported. Many varieties of onion are cultivated but for export only those with average-sized bulbs and of good keeping qualities are grown : " branca de Setubal ", " peryforme amarella ", " saloia " etc. The onions are cultivated in sandy soils corrected by the application of organic manures. Out of the 1919-1920 crops, 8759 tons were exported. The price varies, according to the season of the year from 0.1 to 1.5 *milreis* per kg. (*Revista agricola, industrial e commercial, Mineira*, Vol. I, Part 3, Bello Horizonte).

465. **Bulgaria.** *Cultivation of Roses for Perfume.* — Rose-growing was introduced into Bulgaria by the Turks. Two species are cultivated : *Rosa damascena* (with red flowers) and *R. alba* (with white flowers). The rose-bushes are cultivated in the " rosova dolina " (valley of roses) which occupies a stretch of slightly undulating ground between the Balkans and the Sredna-Gora Mts. It is shut in by chains of mountains that protect it from the North and the South winds and is well irrigated by the rivers Tundgia and Strevna. The mild climate and the soft, permeable, alluvial soil make the valley an ideal place for growing roses for perfume.

The methods of cultivation are, however, primitive, and as the land has been worked for centuries, it no longer yields satisfactory returns.

The rose-bushes produce on an average 30 to 35 tons of flowers per hectare ; the most prolific yield as much as 50 tons, while only 12-15 tons are obtained from old stocks. The roses are grown as an unmixed crop. The largest centres are the districts of Kaenlik, Karlovo, Cirpau, Filippopoli, and Stars-Zagora. The area under cultivation increased from 3016 hectares, in 1889 to 7666 hectares in 1899 and 7666 in 1911. In 1908 there were 20 096 rose-gardens each of an average area of 38 " ares ". The largest surface cultivated was in 1917 (8964 hectares), this rose in 1920 to 6357 hectares. During the War, labour was wanting ; therefore the rose-gardens, although the plants become too old to bear well after 10 years, were not reconstructed. Another factor contributing to this neglect is the fact that essence of rose is often adulterated with inferior essences (*Geranium*, *Pelargonium*, *Ferulago galbanifera*, etc.).

The rose-season lasts from the middle of May to the middle of June. The flowers are gathered between 4 and 8 in the morning, while they are still covered with dew (for in this way the scent is best preserved), and carried in sacks to the distillery.

The distillation is carried out in primitive alambics or at small modern factories. The first tend to disappear ; at the present time, there are 12 well-equipped distilleries supplied with caldrons which can contain 200 to 2000 kg. of roses. The primitive distilleries only possessed a few alambics of copper with stoves burning wood ; the alambics were 1.5 m. high and could contain 8 to 15 kg. of roses and 70 litres of water. Distillation was carried out within 24 hours after the roses were gathered, otherwise the flowers were spoilt.

In the modern factories, in addition to the ordinary rose essence, the con-

centrated essence and the " rosea " essence are made. The concentrated form (extracted with benzine) has a waxy consistency and a strong scent very similar to that of the rose. The GARNIER factory, where this concentrated essence was invented, makes nothing else, the products are, however, turned out by other factories. " Rosea " is a new product prepared in the factory of the Bros CRISTOVI, by means of cold extraction with light benzine, from the rose-water of the first working. It is a brown liquid, obtained, it appears, at the rate of 400 gm. per 1000 litres of rose-water.

Until 1911, the weight of flowers produced was around 12 000 tons per annum. In 1911, 747 700 " muscali " were obtained (1 muscalo = 4.8 gm.) corresponding to 3589 kg. of essence; in 1920, 1634 kg.; in 1921, about 1500 kg., and in 1922 over 2000 kg. The essence trade is in the hands of a few large dealers who export the products chiefly to the United States and to France.

The price (697 gold " levas " per kg. in 1905 and 1795 gold " levas " in 1911), varies around 20 000-24 000 paper levas, which when converted into gold " levas ", is less than the pre-war price.

A law (August 9, 1912) has been passed with the object of organising the production of, and trade in these essences by means of Producers' Co-operatives assisted by Agricultural Banks which will make loans in land securities for the building of modern distilleries. This law has instituted Experiment Stations and Fields, and provides for the presentation of prizes and the granting of subsidies to cooperative distilleries. (B. MORESCHI. *Giornale di Agricoltura della Domenica*, year XXXIII, No. 46, p. 373 Piacenza).

466. **China.** *Exports of Agricultural Commodities from Manchuria via Vladivostok.* — From November 1, 1922 to October 31, 1923 these consisted of 780 million pounds of soya beans, 72 000 bushels of wheat, 8 million pounds of hemp seed, 3 million pounds of millet and 32 million pounds of bean oil in bulk and 269 thousand pounds in barrels. (*Crops and Markets, U. S. Dept. Agric.*, Washington, March 15, 1924).

467. **Cuba.** *Tobacco Growing.* — D. B. PAZUIRIGAN, gives a detailed account of tobacco growing in Cuba under the following heads: Botanical, chemical and histological, tobacco zones in Cuba, climate, soils, fertilisers, seed beds, preparation of fields, construction of shade tents, transplanting, cultivation and watering, topping and suckering, harvesting, poling and stringing, construction of barns, seed selection, diseases and pests, cost of production. (*The Philippine Agricultural Review*, Vol. XVI, No. 3, pp. 174-196, plates 11, Manila, 1923).

468. **Federated Malay States.** *Cultivation of Oranges in the Malay Peninsula.* — Hitherto it has been generally considered that the Malay Peninsula is not suitable for growing oranges; the results obtained have not been satisfactory as regards quality. From recent experiments made in Singapore, however, it has been definitely proved that when propagated by marcottage and careful attention is given to stock, eradication of weeds, and tilth, oranges are obtained of superior quality, equal in size to the best imported varieties and of good flavour. The plants at present yield an average of 200 catties (1 catty = 2.6 lb.) per tree, and the author considers that these results are sufficiently promising to encourage cultivation on a large scale. A general survey

of the methods of cultivation advisable is given by (F. G. SPRING. *The Malayan Agricultural Journal*, Vol. XI, No. 4, p. 74 Kuala Lumpur, 1923).

469. **United States.** *Crop Production per Capita.* — Falling crop production in relation to the population is indicated by comparisons made by the U. S. Department of Agriculture. The average mass of crop production for 1910-1914 being regarded as represented by 100, the average for the five years 1915-1919 was 99.6, for the four years 1920-1923, 95.2, and 1923 has a relative standing of 93.0. Decline began after 1895-1899. Before that period there was increase *per capita* since 1890, when the departments comparisons began

These results are determined by index numbers of crop production, based on the combined production of 10 crops (maize, wheat, oats, barley, rye, buckwheat, potatoes, hay, tobacco and cotton) which have more than 95 % of the total acreage of all crops, and therefore represent the changes in total production. The following index numbers of total production are obtained by applying a constant average price to the yearly production of each crop: 1890-1894, 62.0 — 1895-1899, 78.0 — 1900-1904, 84.5 — 1905-1909, 94.0 — 1910-1914, 100 — 1915-1919, 108.0 — 1920-1923 (4 years), 109.0 — 1923, 109.0. The basis, or 100, is the average for the five pre-war years 1910-1914. (*Crops and Markets, U. S. Dept. Agric.*, Vol. 1, Supplement No. 2, February 1924).

470. *Imports of Forage Plant Seeds into the United States from July 1, 1923 to February 29, 1924.* — Reported by the Seed Laboratory of the Bureau of Plant Industry: Red clover 17 176 500 lb; Alfalfa 10 078 000 lb; Alsike clover 8 341 000 lb.; Crimson clover 6 748 900 lb; Rape 5 366 800 lb. Hairy vetch 2 401 200 lb.; English rye grass 1 664 000 lb; White clover 1 106 100 lb; Chewings fescue 948 400 lb; Italian rye grass 916 100 lb.; Canada blue grass 602 100 lb.; Orchard grass 578 100 lb; Spring vetch 576 700 lb; Broomcorn millet 560 900 lb. (*Crops and Markets, U. S. Dept. Agric.*, Washington, March 15, 1924).

471. *Cotton Consumption in the United States.* — This is continually increasing. In 1921-22 the exports amounted to 6 338 000 bales (500 lb) out of a total output of 11 495 000 bales; in 1922-23 the figures were 11 248 000 bales exported out of 70 65000 bales. In 1909-1919, ten new cotton factories were started with 10 000 employees in Georgia and 30 with 20 000 employees in North Carolina. (*L'Agronomie Coloniale*, Year 10, No. 73, p. 25. Paris, 1924).

472. *Domestic Animals in the States.* — In January 1924 the average value per head was estimated as follows: horses 18 263 000 at $ 64.41; mules 5 436 000 at $ 84.20; cows 24 675 000 at $ 52.16; other cattle 42 126 000 at $ 24.99; sheep 38 361 000 at $ 7.88; pigs 65 501 000 at $ 9.75. This includes stock in addition to those on the farms, either in the towns or in the villages. The census for 1920 shows with reference to the last named: — horses 1 705 611; mules 378 250; cattle 2 111 527; sheep 450 042; pigs 2 638 389 (*Crops and Markets, U. S. Department of Agriculture*, Vol. 1, No. 1, Supplement No. 2. Washington, Feb. 1924).

473. *Poultry Breeding.* — This has made rapid progress; and in 1923 the produce was valued at 1019 million dollars, i. e. about 17 % of the total animal products. The industry is the furthest developed between the Mississipi river and the Rocky Mountains and between Oklahoma and Canada. The estimated value for egg produce in 1923 was 599 million dollars and for fowls

420 million dollars. The number of hens on the farms in January 1924 is estimated at 474 500 000 (*Crops and Markets, U. S. Department of Agriculture*, Vol. 1, No. 1. Supplement No. 2. Washington, Feb. 1924).

474. **Finland.** *Timber Resources and Home Consumption.* — According to praticulars recently published by the Finnish Forest Research Institute about 63 million acres, or 73.5 per cent. of the total area of the country, is covered with forests. Of the cubic content of the forests, redwood accounts for 55.5 per cent., whitewood 24.0 per cent., birch 16.8 per cent., alder 1.5 per cent., and aspen 0.2 per cent. The total supply of timber (bark included) in the country amounts to about 57 606 million cubic feet, which considerably exceeds the timber supply of Sweden, estimated at 45 479 million cubic feet. The annual consumption should amount at the utmost to 1412 million cubic feet. As the growth was calculated to be 1553 million cubic feet, the consumption should be less than the growth. The trees of middle age, in which the growth is largest, proportionately preponderate in the Finnish forest. (*The Board of Trade Journal*, London, April 3rd, 1924).

475. **France.** *Enquiry respecting Workmen's Gardens.* — Enquiries will be sent by the Ministry of Agriculture to the Directors of Agricultural Services in the various Departments.

These number as follows: Ain 1032 — Aisne, about 3400 — Allier 1500 — Alpes Basses A. 197 — Haute A. 470— Ardèche 60 — Ardennes 3000 — Ariège 28 — Aube 494 — Aude 399 — Bouches-du-Rhône 379 — Calvados 176 — Charente 20 — Charente-Inférieure 244 — Cher 826 — Côte d'Or 421 — Creuse 16 — Doubs, about 700 — Drôme 124 — Eure 539 — Eure-et-Loire 714 — Finistère 369 — Gard 303 — Haute-Garonne 57 — Ille-et-Vilaine 545 — Indre 108 — Indre-et-Loire 386 — Isère 1047 — Landes about 200 — Loir-et-Cher 133 — Loire 4695 — Haute-Loire 128 — Loire-Inférieure 130 — Loiret 531 — Lot-et-Garonne 18 — Maine-et-Loir 3030 — Manche 426 — Marne 508 — Haute-Marne 394 — Mayence 436 — Meurthe-et-Moselle 310 — Meuse 1051 — Morbihan 44 and gardeners attached to the Paris-Orleans Railway Company — Nord 3374 — Oise 361 — Orne 812 — Pas-de-Calais 1668 — Puy-de-Dôme 71 — Pyrenées-Orientales 84 — Territoire de Belfort 300 — Rhône 4900 — Haute-Saône 30 — Saône-et-Loire 4600 — Sarthe 820 — Savoie 723 — Haute-Savoie 180 — Seine 5592 — Seine-Inférieure 1034 — Seine-et-Marne 2392 — Seine-et-Oise 5000 — Deux Sèvres 200 — Somme 2360 — Tarn (large number but no precise record available) — Tarn-et-Garonne 180 — Vaucluse 81 — Haute-Vienne 62 — Yonne 1200 — Moselle 940 — Bas-Rhin 340 — Haut Rhin 4365. Only one is to be found in the Alpes Maritimes and none in the following Departments — Hautes-Pyrenées, Var, Vienne. The area under cultivation is in these cases very limited. Some are freehold property, others let at very low prices, and others put up for sale. (*Bulletin de l'Office des Renseignements agricoles*, No. 12. Paris, April 1924).

476. **Indo-China.** *Economic Conditions of Cambodia.* — These are clearly presented by M. E. Delochie de Campocasso (Economic Museum at Phnom Penh) in his work *Le Cambodge économique*, reproduced in the *Bulletin économique de l'Indo-Chine*, Year XXVI, No. 162, pp. 385-411 + 1 plate. Hanoi-Haphong, Sept-Oct. 1923.

The article opens with a brief survey of the geographical situation and the economic and administrative conditions. This is followed by a discussion on the various products :—

Category A. Products that can be directly used and which form the object of regular trade : 1) Industrial products of animal origin : laquer, silk, hides for tanning, feathers, mother-of-pearl shells, and horns, tortoise shell ; 2) Food products of animal origin : dried and salted fresh-water fish, smoked fish, dried sea-fish, " nuoc nam " and " prahkok' ' (fish sauces), fish glues ; 3) Industrial products of plant origin : cotton, kapok, various kinds of fibres, straw-mats, ropes, palm-leaf baskets, tobacco, cotton-seed oil, soap, cotton-seed cake, castor oil, indigo, forestry products, timber, oleo-resin, resin, guttepercha, lacquer, nux-vomica, barks for dyeing, bamboos, Malacca canes, rice-straw cloth, 4) Food products of plant origin ; rice, maize, soy-beans and sesame, palm sugar, sugar cane, cardamom pepper, capsicums ; 5) Mineral products : fine stone from Pailin, plaster ; 6) Products of the small artistic industries : Cambodian objects of art. cabinet-work, statues, pictures, sculpture, cast metal objects goldsmith's work.

Category B. Products that are not of immediate use, but can be worked up : mineral iron, Pursat marble (pagodite), bat-guano, phosphates, fish fertilisers.

From the author's study, it is clear that Cambodia is in full development, as indeed is proved by the following data. From 1912 to 1922, the public revenues rose from 3 918 269 to 7 707 657 " piastres ", while the expenses rose from 3 841 443 to 7 591 170 " piastres ", being thus nearly double. The home and foreign export trade which was 28 million francs in 1912, increased to 144.5 million in 1912. In the course of the last few years, the authorities of the Public Works have done a great deal in the way of road-making ; the network of colonial roads and local paved thoroughfares which extended for 436 km. in 1912, had increased to 1613 km. in 1922, while the extent of unpaved roads rose in the same period from 358 to 770. Another 2000 km. of road have been surveyed and will shortly be begun. If we remember that in order to keep these roads above the maximum level of the water, it is necessary to make them on embankments, we shall have some idea of the magnitude of the task accomplished. The freights carried by the steamers of the port of Pnom-Penh increased from 291 000 tons in 1913, to 461 000 tons in 1921 ; the trade by sailing-boat is still greater, and is slightly increasing in spite of the competition of the steamboats.

Cambodia has great prospects of future development, as is shown by the work in question which supplies interesting information respecting the products of the soil and the waters of the country.

477. **Italy.** *Production of Fresh Forage in Southern Italy.* — In No. 1, 1924, of the *Rivista di zootecnia* (Portici) Prof. E. PANTANELLI, Director of Agricultural Experiment Station at Bari, statest ha the has succeeded in growing at the said Station, without any irrigation, a series of different forage crops from seed sown at the right season, so that fresh fodder could be obtained throughout the entire year, except during 40 days, dating from about July 10 to August 20. The lucerne did well when cultivated on deep soil ; sulla is already well known, although not widely grown. Wild lupin, now little cultivated, might be

more grown, and also broom, and red clover. From the latter, some cuttings were obtained at the Station even between November and March, which is the time when green forage is scarcest. A large amount of fresh forage can also be obtained from trees: the olive (in winter), poplar, stems of the prickly pear (in summer) and especially from polled mulberry-trees. The waste products of kitchen-gardens are also very useful for forage.

478. *Italian Malting Barley* — Prof. N. Brizi has been working for many years in order to obtain good malting barley by crossing local varieties of two-rowed barley with foreign varieties. The Italian barleys used in the researches are already hardy, or have become acclimatised, but possess serious defects as regards malt production, whereas the foreign varieties, although eminently satisfactory from the malting point of view, are either late, or much subject to rust-attack. Prof. Brizi has confined his attention to two types, and since 1916, has specially studied a hybrid resulting from a cross between " Orzola bolognese " and " Orzo inglese ", provisionally called 273 P. V. This hybrid has now been tested with good results in Lombardy, Piedmonte (above Pinerolo at 1.600 m.), in Tuscany and Emilia. It is a polyhybrid very similar to " Primus ", bears a heavy crop, ripens very early and is almost entirely immune to rusts. The barley is most suitable for malting and brewing as the repeated trials have proved. In 1924, it was intended to begin making tests on a large scale and of an agricultural character. (*Annuario dell'Istituzione agraria A. Ponti*, Vol. XIII, 1917, Vol. XIV 1919; Vol. XVI, 1923, Milan).

479. *New Methods of Collecting and Drying Silk-worm Cocoons.* — Before the War, silk-worm cocoons were collected and dried in Italy by the proprietors of the spinning-basins, or by large dealers usually working in cooperation with a spinning-mill. Since the War, however, the conditions have changed owing partly to the great development of co-operative societies for spinning, conserving and selling cocoons (especially in Veneto and the new provinces) and partly to the stoving effected by the silk-worm rearers with a view to selling their products themselves and under the best market conditions. The Dryers' Industry has found itself compelled to follow this new movement by supplying stoves with limited, or limitable output that are simple, easy to operate and take up little space. Of the many manufacturing firms that have tried to meet these demands, the *Movimento agricolo* (Milan, March 15-April 1, 1924) mentions the " Anonima Lombarda Essiccatoi automatici Bianchi-Dubini and Kachel " of Milan which makes a drier called the " Essicatoio Simplex ".

480. *Industry of Canned Food Products in Italy.* — This is in the hands of 381 factories of which 105 are in Campania, and 90 in Emilia; the number of workers employed is about 60 000. The annual output of tinned tomatoes is some 600 000 quintals; about 400 000 quintals of vegetables, and 100 000 tons of fruit are tinned.

481. **Tcheko-Slovakia.** *Present Conditions of Agriculture.* — According to the census of February 15, 1921, the population of Tcheko-Slovakia amounts to 13 611 000 persons of whom 30.6 % are engaged in agriculture and 38.8 % in industry etc. In Czecho-Slovakia, agriculture absorbs 60.6 % of the population, while in Sub-Carpathian Russia, it occupies 67.8 %.

Owing to the diversified nature of the country, the most varied methods and systems of agriculture are found. In the mountainous districts of Tcheko-

Slovakia, and in Sub-Carpathian Russia, sheep-rearing is combined with the cultivation of potatoes for alcohol and starch, on the plains, most of the ground is arable land and cultivated intensively, especially in the river valleys, where sugar beets, wheat and barley are the chief crops.

In 1923, the total area of the country (14 037 419 hectares) was apportioned as follows : arable land 42.05 % — meadows 9.87 % — kitchen-gardens 0.12 % — orchards etc. 0.93 % — vineyards 0.12 % — pastures 3.58 % — woodlands 33.17 % — ponds, lakes, marshes 0.56 % — land that has been built over and waste ground 4.60 %. In the same year, there were 3 187 396 hectares under cereals, (870 thousand hectares were under rye ; 842 thousand under oats ; 687 thousand hectares under barley ; 609 thousand under wheat ; 161 thousand under maize, etc.) ; the industrial crops covered 56 707 hectares (flax, and hemp 12 thousand, hops 8 thousand hectares, etc.), kitchen-gardens 31 689 (24 thousand hectares being under cabbages) ; pulse crops 191 768 hectares ; tuber, or root crops 1 005 364 (potatoes 636 thousand hectares, sugar-beets 232 thousand; forage-beets 102 thousand etc.) ; forage crops covered 1 187 363 hectares (clovers 812 thousand) ; crops for seed, chiefly sugar-beets 6 127 hectares ; fallow land occupied 236 508 hectares.

The period 1914-1918, had the worst effect upon agricultural conditions; the number of horses fell 15 % and that of the cattle 5 % etc. The average unit production of wheat declined from 17.4 quintals per hectare in 1903-13, to 8.6 quintals per hectare in 1918. Since that date, matters have continually improved, so that in 1923, the average production of quintals per hectare was : winter wheat 16.4 — spring wheat 15.4 — rye 15.4 — barley 17.5 — oats 14.9 — potatoes 99.2 — sugar beets 221.9.

The Ministry of Agriculture has drawn up a scheme of insurance against hail, fire and the death of live-stock. Insurance will be compulsory, but the rates are very low.

The number of hectares of land requiring improvement has been estimated at 1.5 million.

In all the Tcheko countries, and to a still larger extent in Tcheko-Slovakia, and Sub-Carpathian Russia, large estates are the rule, but owing to the great social advantages of the small holding, a series of laws enabling the agriculturist to acquire small properties were passed between November 19, 1918 and June 30, 1922. The largest number of live-stock per hectare is reared in the small holdings. (*Publication of the Ministry of Agriculture of the Tcheko-Slovakian Republic, Prague, February* 1, 1924).

482. **Tripolitania.** *Agriculture and Viticulture in Cyrenaica.* — Cyrenaica, properly so-called, has less than 200 000 inhabitants (less than 30 per km^2), whose chief industry is the care of travelling flocks of sheep. The agriculture of the country is limited almost exclusively to sowing and reaping the barley crops and tending the luxuriant orchards that occupy the gardens of the houses. In the woody zone of the plateau, olive-trees perhaps to the number of 2 million are to be found but they have relapsed almost into a wild condition and no one troubles to gather their often heavy crop of small fruits.

The plateau of Barca, taken as a whole, has a carsic structure and facies ; wherever the limestone comes to the surface, no crops can be cultivated. In the valleys, there are accumulations of the decalcified red soil which, although

somewhat difficult to work, contains plenty of fertilising elements. Some of the valleys are very small while others, like El Merg (30 000 hectares), are very large.

Viticulture is thoroughly primitive. There are few regular vineyards and these are to be found almost exclusively near Bengasi where they were planted by the Italians. Vines are, however, very commonly grown in the gardens that exist in the inhabited centres of the coast and the northern slope of the Barca plateau, while they are dotted about wherever there are springs, caravan halting-places, or military forts. The Arab only plants the vines and gathers the fruit; he never works, or manures the soil, neither does he prune the stocks; but his half-wild vines are laden with bunches and the fruit is frequently very fine. All the grapes are table-fruit; an unsuccessful attempt was lately made to rise them for wine manufacture, but the product had no good organo-leptic qualities and soon lost quality. The ripening season varies according to the vines from the second half of June to the whole of September. The best vines are "Turchi" — "Zagtèra" — "Razaghi" and "Garngazèl". It is said that they were introduced from Crete. (G. DALMASSO, *L'Italia agricola*, No. 2, 1924; *Enotria*, Mo. 2, 1924).

483. **Turkey in Asia.** *Agricultural Conditions of the Vilayet of Adana.* — In ancient times, the Vilayet of Adana, known as Cilicia, was renowned for its richness and fertility. Cotton, cererals, kitchen-garden and oil-bearing plants all flourished there. The total area of the vilayet is about 40 000 km² distributed as follows: 28 000 km. of arable land on the plains and plateaux; 10 000 km. mountainous land and woodlands, while the rest consists of swamps that could be converted by drainage into land suitable for cultivation. Before the War, only 30 % of the arable area was cropped; at the present time, scarcely 4000 km² are being cultivated. This relapse is attributable to lack of labour and of machines. The average production in normal years is 13 to 24 *sementi* in the case of wheat; 12 to 20 in that of barley, 18 to 25 of oats; 15 to 18 of maize; 17 to 22 of pulse; 35 to 45 of sesame; 500 to 000 kg. of cotton per hectare; 500 to 600 kg. tobacco leaves per hectare. The cotton production before the War was 120 000 bales weighing about 250 kg. With improved methods of cultivation, it would be possible to obtain 500 to 600 thousand bales. The vast forests of pines, beeches, cedars, juniper, oaks, white and black spruces, lime-trees and ungraftable wild olives could be worked. The villagers of the forest districts are employed in cutting the trees and making charcoal and vegetable tar.

The arable soil is nearly all clay. The tractors to be introduced must be able to plough to a depth of 30 cm. over an extent of 6-7 hectares in 10-11 hours, and be transformable into fixed engines. The ploughs should have 4, or 5, shares; while the harrows, cultivators and sowers ought to be large and provided with an arrangement for attaching them to the tractors.

All reapers and harvesters must be able to cut very high (20-30 cm.). The threshers ought to be of medium size. (*Bulletin de l'Office de Renseignements agricoles*, Paris, April 1, 1924).

484. *Development of Cotton Growing in South Africa.* — Many parts of South Africa, particularly in the Northern and Eastern Transvaal, are peculiarly adapted for the growing of cotton, and a good deal of attention has been di-

rected recently to the vast stretch of land in Natal, extending from Matubatuba eastwards towards Portuguese territory in which area almost unlimited crops of high-class cotton can be produced. In the year 1908-1909 the production of cotton-lint in the Union amounted to 31 169 lbs,, wlist during the year 1922-23 the production amounted to 2 400 000 lb. The average yield is about 600 lbs of seed-cotton per acre equal to 200 lbs. of lint and 400 lbs. of seed. There are now about 16 000 acres under cotton cultivation in the Union, a large proportion of which is situated on the Pongola Poort and Candover Estates, more than one hundred miles east of Somkele, and the areas will be increased considerably during the next few years. It is estimated that 4 million acres of land in the Union are suitable for the production of cotton. The Union is free from boll weevil. (*The Board of Trade Journal*, London, April 3, 1924).

Rural Hygiene.

485. *The Antineuritic Vitamine* are very diversified, as Prof. G. GAGLIO (*Atti della R. Accademia dei Lincei*, Vol. XXXII, Part 12, pp. 479-482) has stated, thus disposing of any idea of the existence of a single specific substance. These vitamines are present in the embryos of cereals, in germinating seeds, in edible fungi, in rye, and in urine, etc. Of all the substances tested by PANTALEONI, MATTEI and the author, rabbit urine proved the most efficient. The question at once arises as to which of the constituents of urine has this antineuritic action. It has been found that the action of the ammonia is incomplete, while the other two substances present in rabbit's urine had little, or no effect, when used alone. The fact that antineuritic vitamines are not a specific compound has been proved by the decrease in the power of rice-bran or beer-yeast, which gradually shows itself as they are purified. Not all antineuritic vitamines become labile under the influence of heat: coffee, or cacao, beans when roasted at 230-240° C and infused produce an infusion with a distinct preventive and curative vitamine action.

Dr. Atherton SEIDELL, chemist at the U. S. Public Health Service Laboratory at Washington has prepared from brewer's yeast a definitely crystalline compound that has the antineuritic properties of vitamin B. He used fuller's earth to absorb from a solution of yeast the active vitamin principle and after precipitating with picric acid and subjecting this product to many solutions and crystallizations, pale yellow, transparent, crystalline flakes were obtained that in doses as minute as 2 milligrams a day protect pigeons from the effects that follow lack of vitamin B. Therefore, whereas there has been a tendency in the past to regard vitamins as substances comparable with enzymes and toxines in their stability and marked activity of infinitesimal doses, evidence has now been obtained that the antineuritic vitamin performs its function in doses of convenient magnitude and withstands ordinary laboratory manipulations. (*Science*, Vol. LIX, No. 1525, p. XII. New York, 1924).

486. *The Different Biological Races of Mosquitoes. — Stock-breeding as a Means of Malaria Control.* — The question of the favourite food of mosquitoes is far more complicated than has been supposed by some persons (See: RONBAUD and LEGENDRE R., 1920, No. 1), and the hope of using domestic animals in the campaign against malaria can only be realised, if ever, after long and exhaustive

researches have been carried out. This is due to the fact that in the various species of mosquito, there are different races with different habits. Thus, as regards *Culex pipiens*, Prof. B. GRASSI (*Atti della R. Accademia dei Lincei*, Vol. XXXIII, Part 12, pp. 457-464, Rome, 1923), state that some races only suck blood and lay eggs once, while others suck blood several times and lay eggs several times, and others again appear never to suck blood at all. The author has not so far found any mosquitoes that prefer the blood of birds to that of man.

487. *The Zoophily of some Mosquitoes and its Application to Prophylaxis.* — The researches of J. LEGENDRE (*Comptes rendus de l'Académie des Sciences*, Paris, Vol. 177, No. 17) show that: 1) *Culex pipiens* is often zoophilous from the biological standpoint; the forced domestication of the larvae of the wild species *Anopheles maculipennis* has not rendered it androphilous in its winged stage and *Culex pipiens*, a domestic species noted for its androphyly, has become androphobous under conditions that ought to have preserved its trophism for man; 2) from the prophylactic standpoint, it would be advisable to introduce into regions where *C. pipiens* and *Anopheles maculipennis* attack man, these and other zoophilous species. In this way, a struggle for life between the zoophilous and androphilous species would take place in the waters where they breed which would be a great advantage and would cause no difficulties.

488. *Critical Observations on the Theory of Misanthropic and Zoophilous Anopheles.* E. MARTINI (*Office International d'Hygiène publique, Bulletin mensuel*, Vol. XV, No. 5, pp. 686, Paris) does not believe in species of *Anopheles* which, as a result of adaptation, have stopped biting man and turned their attention to animals. It is true that in the countries of the temperate zone, *Anopheles maculipennis* rarely attacks man, but there is no proof that it behaved differently formerly, or that its change of behaviour has not been caused by alterations of the environmental conditions. Malaria once existed in regions from which it has now disappeared owing to the extension of cultivation, building, drainage, ditches, etc. The habits and dwellings of the inhabitants have also been altered by the improvements that have been made. Houses with high ceilings which are cool and well-ventilated suit the *Anopheles* much less favourably than low, hot, damp dens and sheds. There are seasons when these mosquitoes enter dwellings and seasons when they remain outside. There is no doubt that they are attracted by the smell of a stable; it has been proved that odours have much to do with determining their behaviour. Finally, it is quite possible for *A. maculipennis* to bite human beings without their noticing it, since it is a nocturnal insect and the punctures it makes give little pain.

M. ROUBAUD mentions the existence of a race of *A. maculipennis* which is adapted to live-stock, as it is larger and supplied with mandibles having more numerous teeth. It frequently happens, however, that the size of certain animals increases in cooler regions and the larger number of teeth would be in keeping with the increased size. The introduction of live-stock into a malarial district may certainly perceptibly reduce the number of human beings infected.

489. *Antimalarial Fish.* — Since 1921, L. O. HOWARD has been advising the diffusion of fish that are the natural enemies of mosquitoes; amongst these

useful fish, he mentions *Gambusia affinis*. VAN DINE stated (1) in 1907, that the had introduced this species into Hawaii for the express purpose of destroying mosquitoes. Prof. SUPINO imported some of these fish into Italy in 1908 for he purpose of making laboratory experiments with the result that he does not recommend *Gambusia affinis* being acclimatised in Italy, because not only has it no food value, but as it does not live exclusively upon mosquito larvae, it would not probably be more useful than the nativo species in destroying these pests. As long ago as 1906, TERNI had proposed to render pisciculture a more efficacious means of antimalarial control. BRUNELLI (1911) reported the antimalarial value of the " nono " (*Cyprinodon calaritanus*) the " spinarello " (*Gasterosteus aculeatus*), the " latterino " (*Atherina*). Other persons have also mentioned as useful the mirror carp (*Cyprinus carpio* var, *specularis*), the gold fish of China (*Carassius auratus*), the " scardafa " (*Scardinius erythrophthalmus*), the " triotto " or " rovello " (*Leuciscus sula*) and the eel. Prof. B. GRASSI, however, draws attention to the fact that these antimalarial fish lose their efficiency if they are not in ponds free from water weeds, for when the latter grow strongly, the anopheles larvae finds refuge amongst the thick masses of vegetation. It was discovered by experiment that in basins with very few aquatic plants, *Cyprinodon calaritanus* destroyed all the larvae in a short time, whereas in basins full of thick masses of plants, even a large number of the fish failed to reduce the swarms of anopheles larvae. Negative results have been obtained at Fiumicino from experiments in destroying anopheles larvae by mean of fish (especially *Cyprinodon calaritanus*). The fish-ponds at the mouths of the Arno and the Tiber are full of eels, yet the anopheles larvae thrive there.

In 1922, Prof. GRASSI obtained some specimens of *Gambusia* from Spain, where this fish has already become acclimatised and had them introduced into the lake of Porte, the water-tank for supplying the hydraulic pumps at Ostia, and into a pond in the Pontine Marshes. In all these places, the fish have propagated themselves extensively, but they are only to be found at the edge of the water where the vegetation is thinnest ; they seem unable to penetrate the thick masses of water-weeds amongst which the anopheles live undisturbed.

490. *Hay Baths.* — These are taken in some of the mountainous districts of the Upper Adige and especially in the Sciliar (Schlern) and the Monte Rocca (Schwarzhorn) districts. The only hay suitable for the purpose is that made from grass growing on Alpine meadows viz. those beyond the tree-limit, where there is a rich flora composed of primulae, gentians, *Arnica montana*, *Artemisia* spp., *Nigritella*, *Valeriana* etc. The grass is mown from the middle of July to the end of August, and as soon as it is dry, is transported on carts to the ricks and afterwards taken down lower. During the transport, which lasts 5 to 10 hours, active fermentation sets up with the evolution of heat (60° C. and over), therefore special care is needed in unloading it. The fermentation is allowed to continue a long time (up to 2 months). Then the hay is piled up into heaps of 1-1.50 m. high on the bath-rooms, and left for a few days, after which a hole of the size and shape of a bath is excavated in the heap of hay. The patient is wrapped in a sheet and laid in this hole, the rest of the hay being

(1) See: *R.* 1916, No. 251. (*Ed.*)

piled over him, so that only his head is exposed. He remains in this position for three-quarters of an hour during which time he perspires profusely; then he is dried and put to bed until he ceases to perspire. Establishments for hay-baths (" Heubäder ") are to be found at Fié, in the Siusi Alps, the Occhini mountains, at Carano, Varena, Valdagno etc. Hay-baths are used for the treatment of affection of the joints, neuritis, neuralgia, gout, obesity, liver complaints, and chronic nephritis. Their action has been studied by several doctors amongst whom are Dr Josef Clara (*Südtiroler Aerztebiatt*, August, 1922) and Dr Dr Leonardi of Cavalesi (*Le Vie d'Italia*, Year XXX, No. 4, pp. 351-355, Milan, 1924).

Experiment Stations and Agricultural Instruction.

491. *Centres for the Scientific Study of the Tanning Industry.*

Austria. — Tannery school and Station for the Leather Industry at Vienna: these are Government Institutes under the direct management of the Ministry of Public Instruction.

Belgium. — " École de Tannerie " of Liege founded in 1899.

France. — " École française de tannerie " founded in 1890, by the cooperation of the " Syndicat général des Cuirs et Peaux de France " and the Chair of Applied Chemistry of the University of Lyons. It has been affiliated to the school of Industrial Chemistry and is installed in the premises of the Chemical Institute. It has a teaching Museum annexed. This school was ecognised by the State on January 3, 1922. Its object is the training of Chemists, Technical Managers and Heads of Departments for the leather trade and other kindred industries.

Germany. — 1) The Tannery School of Freiberg (Saxony), was founded in 1889. In 1897, an Experimental Section was added which also serves as an Analitical laboratory for all commercial transactions concerned with tannery products. The character of the school is more technical than scientific.

2) An Institute of Scientific Research Applied to the Tanning Industry has recently been founded at Dresden where it forms part of the " Institut Kaiser Wilhelm ".

3) A Research Laboratory connected with the Tanning Industry has lately been instituted at Darmstadt

Italy. — 1) The " R. Istituto Nazionale per le Industrie del Cuoio " (Royal National Inst. for the Leather Industry) was founded in 1902; the teaching given is both professional and scientific (1).

2) An Experiment Station exists at Turin and at Naples. The Naples Station specialises in matters relating to the skin-trade and especially to glove-making (2).

(1) To the Institute there is annexed a Technical Laboratory for Experimental Tanning Tests. (*Ed.*)

(2) See *Bollettino ufficiale della R. Stazione sperimentale per l'industria delle pelli e delle materie concianti* (Turin, Via Biella; Naples, Via Poggio Reale, 59), Year I, No. 1, August 1923. The object of this publication is to make known the teaching, technical and experimental work of the Station. (*Ed.*)

United States. — In 1917, the American Leather Research Laboratory was founded in New-York. In 1924, this laboratory was transferred to the University of Cincinnati and included as a foundation of the Tanners' Council in the Technicological Faculty of the said University. (MUNIER L. *Recherches et Inventions*, Year 4, No. 7. Paris).

492. **United States.** *Organisation of Scientific Men.* — The need of a professional organisation including workers in Universities, Academies, Museums, private scientific and intellectual institutions and in the service of State and federal Governments is emphasised. This should insure the social and economic welfare of the intellectual worker and tend to increase the value of his contribution to the common interests. Amongst the legitimate objects of such an organisation are included the following :— Educate the public as to the work being carried on and bring to the fore the value of the technical expert ; Educate the expert in the basic principles of sociology, economics, world history and practical politics, which underlie the present social structure, to the end that he may better protect his own economic interests and take a more active part in public welfare ; insist on higher standards of preparation for intellectual workers, to encourage all-round efficiency ; co-operate with other organisations with similar objects and advocate the formation of an " American Confederation of Intellectual Workers. " to be composed of all organisations of adequately trained workers, striving for the social and economic advancement of their members, not only from the point of view research product but also as a worthy contribution to human progress. (*Science*, Vol. LIX, No. 1523. March 7. 1924).

493. **Great Britain.** *Recommendations for Future Work of the Imperial Institute, London.* — The opinion has been expressed that the most essential function of the Institute should be that of a clearing house for collecting and disseminating information and for conducting through an appropriate, scientific, technical, and commercial organisation, enquiries and investigations regarding the raw materials of the British Empire. It is suggested that such work should be extended and that a representative selection of Empire products should be made for the purpose of a travelling exhibition of a purely educational character, and that the possibility of organising travelling exhibitions of the staple products of the Colonies and Protectorates in the appropriate trade centres should be considered. At the same time the " clearing house " should be developed and all enquiries entailing elaborate investigation should be referred to competent authorities. Reliable up-to-date sample rooms, illustrative of important raw materials should be maintained.

494. **France.** *Wheat Trials in the Department of Bouches-du-Rhône.* — In 1922 (a year of drought), Rieti, Gentil rosso, Inallettabile and Cologna took the first place, whereas in 1923 (a cool year very favourable to wheat), the post of honour was held by " Blé des Alliés " (which ranked last in 1922). This wheat, produced 21 quintals per hectare ; next came Carlotta Strampelli and Toscane both of which did badly the preceding year. The local varieties " Tuzelle " (17 quintal per hectare) and " Aubaine " (almost 20 quintals) maintained a good place. Thus, in cool, wettish seasons (except in South France), wheats with high yield such as " Blé des Alliés " and the other new hybrids " Wilhelmine ", " Selecta Imperia " No. 1 and " Hybrid 23 de Vilmorin " give excellent results ;

whereas in dry years, which are of frequent occurrence the better adapted and more resistant native wheats of the south do best. (*La Vie Agricole et rurale* 1924, No. 7, p. 109).

495. *Seed-Potato Selection and Control in Loiret.* — The districts of Orleans and Gatinais have long been famed for the production of potatoes and especially of seed-potatoes. In order that these districts shall continue to enjoy this distinction, the " Office agricole départemental du Loiret " has organised the inspection of fields under potatoes, especially those where selected plants are cultivated. The varieties inspected were (in order of importance) " Belle de Fontenay " (" Boulangère "), " Roscoff ", " Royale " " Belle de Juillet ", " Holland ", " Royal anglaise ", " Mayette ", " Saucisse " etc. (*Ibidem*, January 19, 1924).

496. **Indo-China.** *The Pasteur Institutes of Indo-China.* — The *Revue Indochinoise*, Nos. 5-6, pp. 571-587 contains a review of the work of D. Noël Bernard (Director of the Pasteur Institutes of Saigon), entitled *Les Instituts Pasteur d'Indochine* (Saigon, Imprimerie nouvelle, Albert Porta), in which the author describes the work carried out at these institutes since 1890, the date of the opening of the first laboratory, until 1922. The book is divided into four parts : 1) an account of the fundation of the Saigon and Nha-trang Institutes and of their affiliation with the Pasteur Institute in Paris under the name of the Pasteur Institutes of Indochine ; 2) their development and practical work ; 3) review of published original researches ; 4) bibliographical index of the latter publications.

1 and 2) The Pasteur Institutes include laboratories of medical microbiology, veterinary biology and chemistry. All the microbiological diseases of man in the tropics have been studied there, and certain vaccines (anti-small pox, anti-plague serum, anti-typhoid vaccine, etc. have been discovered in these Institutes. At Nha-Trang, there are human therapeutic serums sent by the Paris Pasteur Institute. In 1922, a vaccine laboratory was opened for the preparation of vaccines required by doctors in individual cases that need ordinary therapeutic treatment. In 1919 a laboratory was started of animal biological serums ; here " barbone ", one of the most dreaded local epizootic diseases is being studied as well as foot-and-mouth disease, " surra ", anthrax, rinderpest and hydrophobia. In 1921, vaccination against " barbone " was required in the case of 461 buffaloes, while during the first 9 months of 1922, 1184 buffaloes and 269 cattle were inoculated against this malady.

The Chemical Department includes both chemical and biological laboratories where analyses of milk, blood cephalo-rachitic liquid etc. are made ; the Official Laboratory for the suppression of food adulteration (which has shown itself especially active in the case of " moc-mam ", a fish sauce much used as an article of food by the Anamites) ; a Laboratory where studies and researches on rubber are carried out with a view to obtaining information useful to planters, and discovering the effect exerted on the industrial value of the product by the methods of cultivation, and the coagulation and manufacturing processes.

3) The Pasteur Institutes of Indo-China have carried out 37 original researches of which we may mention the following : (1) Breaudant " Studies on Beriberi ", in this paper, the author gives his opinion of the origin of this disease which he considers to be due to the butyric propionic fermentation of rice and

other starchy substances in the digestive canal. The spread of the disease is probably caused by the infection of food by flies. It cannot, however, be asserted that beri-beri is in all cases a purely alimentary disease. (2) Studies on silkworm selection directed not only to obtaining large cocoons with heavy yield for the spinning-basins, but also to regular homogenous production. The experiments made have clearly shown that for the latter purposes it is necessary to have recourse to crossing. (3) CH. BROQUET has discovered a new silkworm disease called " rouge du papillon du vers à soie " and has studied a tachnid parasite on the silkworm. (4) M. BREAUDAT has isolated from the water of Saigon a short, thick bacillus, *B. violaceus acetonicus* ; live-stock drinking water in which this bacillus is found become much emaciated and are attacked with diarrhoea, the faeces being of a yellowish colour.

Chinese market-gardeners have the habit of spraying their plants with a liquid fertiliser of which the base is ground-nut cake. BREAUDAT has studied the composition of this fertiliser and States that owing to the fermentation of the ground-nut cake its use as a spray constitutes a real danger to the inhabitant of the provinces eating the raw vegetables that have been thus treated. He proposes that the ground-nut should be used in the form of a coarse powder mixed with soil.

In order to remedy the lack of lime in human food, it is suggested that lime water should be used for making bread, boiling rice, watering ground on which vegetables are to be planted, and that lime should be introduced into drinking-water.

In 1920, M. LAHILLE studied the composition of coconut milk which is frequently used as a beverage. It appears to possess valuable diuretic properties, and to be antiseptic.

497. **Italy.** *Agricultural Experiments in Italy.* — The Government recently decided, the suggestion of the Minister of National Economy, to create the " Fondazione per la sperimentazione e ricerca agraria in Italia " with its head-quarters in Rome. This Association, which is a Public Body, has been instituted for the purpose of providing Institutes engaged in technical experiment and in economic researches with special funds (in addition to the means at present at their disposal), for the purpose of developing and co-ordinating their work in the interest of national agricultural economy. The Government has endowed the foundation with a capital of 40 million " lire ". (*Il Movimento agricolo*, Milan, March 15-April, 1924).

498. *Trials of Strampelli Maize.* — In the " R. Scuola Agraria di Ascoli Piceno " gave the following results in 1923 (a dry year) " Savario Strampelli 'i 28.8 quintals grain per hectare ; " Ideale " 27 ; " Luigia Strampelli " 25.9 ; " Pioniere " 24 ; " Principe Potenziani " 23 ; " Alfredo Strampelli " 19. The local varieties in normal year seldom produce more than 20 quintals per hectare. (N. BOCHICCHIO. *Il Coltivatore*, No. 7, 1924).

499. *Forages for Dry Climates that could be tested in Italy.* — Dr. BOVOLO advises (*Il Coltivatore*, No. 12, 1923) experiments being made with *Pueraria Thunbergiana* (*Pachyrhizus*) *Thunbergianus* as a drought-resistant plant. Doctor B. BALDRASI (*Ibidem*, No. 1, pp. 7-10) says that it was introduced long ago into Italy as an ornamental climber and stands the climate very well. It now remains to find out by experiment how far it can resist drought

The nearly related species, *Pachycladus anguicaus* which grows wild in Erithrea, is of little value for fodder, the young stems may produce tympanitis, as the author has discovered, and they soon become, hard, fibrous and unusable. The plant also produces edible tubers of high food value that could possibly be employed as forage but these tubers only form in the rainy season which is followed by a long period of drought; conditions that do not exist in Italy.

More promising results are to be looked for from experiments with different species of *Atriplex*. Since 1903, the author has introduced into Erithrea several Australian species of *Atriplex* (the best being *A. auriculaeformis*, and *A. halimus* from Italy which are all during well. *A. halimus* and *A. semibaccata* now grow wild in the colony, where they have proved resistant to all adverse conditions, including grazing, even when it is badly regulated and excessive. *Rhagodia hastata* is recommended to agriculturists possessing saline soil and requiring grazing for cattle, as this plant possesses all the good qualities of *Atriplex*, but is finer and makes better hay.

In Italy, *A. halimus* grow in the sea-shore on saline soil, as well as in the high mountains, on rocky ground of various kinds. In Apulia, it has been met with at an altitude of 800 m. and also at a distance of 70 km. from the coast. Its resistance to drought is undoubted.

500. *The Effect of Soil Colour on Sugar-Beet Development* has been studied by D. N MOSTARDINI at Lendinara (Province of Rovigo). Before sowing, and 8 days after the first weeding, some of the plots were sprinkled with powdered carbon from the sugar-factory the others were untreated and served as a control. The beets in the first set of plots grew more luxuriantly than those of the control plots and on analysis were found to contain 15.1 % of sugar and have a purity quotient of 77.1; the figures of the control plots being respectively 13.93 % and 85.07 (*Il Coltivatore*, No. 1, 1924, p. 6).

501. *The Royal Experiment Station for Tobacco-Growing at Scafati* (Salerno) is divided into three distinct departments: an agricultural, industrial and teaching, respectively; 1) in the Agricultural Department, studies on the more careful selection and conservation of seeds are carried out, and experiments are conducted on: the effect exerted by various methods of seeding, and different types of seed-bed upon the growth of the seedlings; the selection and improvement of the existing types of tobacco which have the greatest industrial value; the creation of new hybrids that better answer the consumers' requirements, the improvement of the curing methods now used, and the discovery of others that may possibly answer better. There is a botanical sample-book containing all the species cultivated which have been collected for teaching purposes and phylogenetic study; 2) In the Industrial Department, extensive experiments are being conducted in fermentation and in working up the native products, so that the material may be further improved and rendered more suitable to replace the products now imported from abroad; 3) the Teaching Department organises theoretico-practical courses for specialists in tobacco-growing. The working expenses of the Institute amounted to 1 383 000 "lire" on 1920-21. (Extract from the *Relazione e Bilancio preventivo della R. Azienda dei Tabacchi* for the financial year from July 1, 1920, to June 30, 1921).

Ministero delle Finanze, Direz. Gener. Monopoli Industriali. Rome, Tip. Coop. Sociale, 1923).

502. *Experiment Station for Live-Stock Diseases at Sassari.* — This Station has been fouded by means of a grant from the " Ministry of the Interior " (General Health Department) and with the help of contributions from local Public Bodies. It started work in January 1924 ; one of its tasks is to study the stock-diseases of Sardinia for, so far, little is known of their etiology.

503. *Studies on Fowl Cholera* have been carried out at the University of Perugia by Prof. ARUCK and his Assistant D. NICOLA BRIZZI who have used with signal success a remedy they had made in the Briazzi Chemico-Pharmaceutical Laboratory at Florence. This preparation called " coleravio " has prophylatic, disinfectant and curative properties and has been widely tested.

504. *Work of the Royal Experimental Oil-Factory of Umbria During the Last Decade* (Spoleto, Panetto and Petrelli, 1923). — Under the above title, the Director, Prof. FLAMINIO BRACCI, gives an account of the teaching and experimental work of the Institute. As regards the researches, the following papers may be mentioned :

Acidity of Oils in relation to their Quality and to their Use. — Prof. BRACCI shows that a certain relation exists between the degree of acidity, smell, taste and comestible quality of oils and he urges the Sanitary authorities dealing with such matters to undertake careful researches in order to determine the degree of acidity permissible in oils intended for food purposs.

Oil Content and Mechanical Yield of Olives. — The author shows that it is not possible to establish any connection between the absolute oil content of olives and their industrial yield.

Decrease in Oil Must as a result of Clarification and Filtration. — From 3 to 5 % of oil remains in the deposit after clarification ; when filtration is preceded by thorough clarification, the loss is below 1 %.

Contribution to the Study of Olive Skins : 54 analyses ; extreme values : moisture 33.34-34.90 %, crude fat in skins 5-13.42 %.

Alimentary and Medicinal Uses of Olive Oil. (Propaganda pamphlet for Bosnia).

Oil-Factory Residues now and in the future. — A description is given of the equipment of factories for the rational exploitation of these residues.

The Demonstration Oliveyard of the Royal Experimental Oil Factory at Spoleto. (Cultural experiments).

Experimental Oliveyard of the Lucchese Sea-Coast (Campo Romano). Improvement and planting experiments.

Olive yards of the Sabina : Improvements and Reconstruction Work.

Problems of Olive-tree Cultivation : Report presented on " Olive-tree Day ", March 18, 1923.

505. *Work of the Experimental Cheese Factory at Lodi* Vol. II, Part 1-2 of the *Annali dell'Istituto Sperimentale di Caseificio* contains the following articles. G. FASCETTI *Relazione sommaria sull'attività dell'Istituto Sperimentale di Caseificio nell'anno* 1922 (short Report of the Work of the Experimental Institute of Cheese-Manufacture for the year 1922). — E. SAVINI. *Relazione sul servizio di analisi* (Report on the Service of Analyses). — G. FASCETTI, *Riforma generale della legislazione italiana dei latticini.* (General Reform of the Italian Legislation

Referring to Dairy Products) Order of the Day proposed by the presenter of the report and approved by the Congress of Reggio Emilia, 1923. — G. DALLA TORRE *Influenza delle bacinelle nella conservazione del latte* (Influence of the Receptacles on the Keeping Qualities of Milk). — G. FASCETTI. *Sul calo del formaggio grana estivo specialmente nel corso della salatura* (Decrease in Summer "Grana" Cheese, especially During Salting). — G. FASCETTI *Mostra casearia di Carrù, Relazione.* (Cheese Exhibition at Carru, Report).

Part 3-4 contains: *Contributo allo studio dei fieni-silo in rapporto al latte e derivati.* (Contribution to the study of Hay-silage in Relation to Milk and Dairy Products): I. G. FASCETTI, *Ricerche sull'umidità e sull'acidità dei fieni-silo* (Researches on the Humidity and Acidity of Hay-silage). — II. G. DALLA TORRE, *La microflora dei foraggi insilati.* (The Microflora of Silaged Forages).

From the results of the experiments described in his first work, DELLA TORRE draws the following conclusions: The old custom of using copper basins in Lombard cheese factories in order to make the milk keep better has proved scientifically advisable. In fact, the number of micro-organisms present in milk kept in small copper basins was 2 to 2.6 times lower than when tinned iron vessels were used. This difference becomes much more marked under the conditions (particularly thermic conditions) that promote the multiplication of micro-organisms especially of the common species (lactic ferments etc., favourable, or unfavourable, to cheese-making) in the milk kept standing in the basins. Keeping milk, during warm weather especially, in deeper vessels, instead of basins, causes the rapid multiplication of micro-organisms particularly those that like some what high temperatures. viz., the *coli-agrogenes* and other lactic bacteria.

The observations made by FASCETTI on the decrease of "grana" cheese show that between July and September the total decrease in 75 forms (not calculating the salt which penetrated into the cheese during the salting-process, was 11%. This decrease which takes place in the first 3 summer months, is about two-thirds of the total decrease that generally occurs in this type of cheese by the time it is completely ripe (between 18 and 24 months) which varies from 18 to 20 %.

From his researches respecting the moisture and acidity of hay-silage, FASCETTI reached the following conclusions: 1) the term hay-silage should not be applied to all silage prepared according to the so-called Cremascan method (see p. 332 of this *Review*) if by hay-silage is understood forage that has been previously dried to the extent of a moisture content not exceeding 40 %;

2) Silages containing 50 % of moisture must be included in the grass-silage class, as they have all the general and specific characters of the old type of silage;

3) The chief characters that distinguish grass-silage from hay-silage are the different degrees of moisture present, the amount of free volatile acid, which, given equal length of conservation, is greater in the case of grass silage, and finally the difference in the composition of the acids producing the said acidity;

4) The volatile acidity appears usually to depend upon fatty acids with 2-4 atoms of carbon in the case of hay-silage, and with 2-6 atoms of carbon in the case of grass silage;

5) In hay-silage that has been kept long, there may be a large quantity free acids which presupposes late specific fermentation ;

6) The acidity of hay-silages, when kept for the same length of time, is in relation to the degree of moisture ;

7) In dry hay-silages made in the autumn, the degree of volatile acidity is almost equal to that of the hay made from the same grass as the silage, provided both have been kept for the same time.

DALLA TORRE draws the following general conclusions from his researches on the micro-flora of hay-silage :

The organoleptic characters of th hay-silages were as a rule good, and even excellent when the moisture content was less than usual, only a few cases were unsatisfactory in this respect, their deficiency was due to the moisture percentage having risen above the average owing to the wet weather.

Generally only a few species of micro-organisms were present : their number per gm. varied from some thousands to several million. Among the most common micro-organisms were the saccharomycetes, which often occurred in considerable numbers ; aerobic sporogenous bacteria were always present and also the lactic ferments and sometimes the latter were so numerous as to make up the larger proportion of the microflora. The high lactic bacteria content of hay silages, even after they have been some months in the silos, leads us to suppose that before, or during, the silaging, these schizomycetes had multiplied to a great extent, probably as a result of the moisture which although slight is sufficient to permit of the development of certain ferments, especially at favourable temperature.

In all the hay-silages examined, the number of micro-organisms gradually decreased on passing from the surface to the bottom. The decrease in the lactic ferments varied according to the environmental conditions ; it was specially noticeable in the case of the streptococci which are either entirely absent at the bottom of the silage, or only occur to a very limited extent.

The butyric ferments are some of the rarest micro-organisms of hay-silage ; the moisture of the forage is probably the chief factor affecting their number. These ferments in hay-silage multiply freely in their passage through the digestive system of cattle. The faeces evacuated when the animals have consumed hay-silage rich in butyric ferments contain the largest number of these micro-organisms which proves that, generally, there exists a certain relation between the above-mentioned gasogenous micro-organisms present in hay-silage and the faeces respectively, which is a fact of importance also from the point of view of the fermenting properties of the butyric enzymes.

If the faeces evacuated during the time the cattle have been fed on hay-silage are compared with the dung produced in the course of the immediately succeeding period of grass and hay, or only grass feeding, the number of butyric ferments will be found much lower during the second period.

Few butyric ferments were found in the milk and in any case, their number varied considerably, being influenced, not only by the quantity of these micro-organisms present in the faeces, but also by the consistency of the excreta and the rules of cleanliness observed before, and during milking. Excellent coagulates are always obtained in fermentation tests carried out with the milk of cows fed on hay-silages. This shows that the butyric ferments associated

with the other components of the milk microflora are unable even under the favourable conditions offered by the above tests, to produce deleterious fermentation. It would seem probable that in practical work also, where the number of butyric ferments in the hay-silages is limited, and also in the case of dairy products where active, copious and constant lactic fermentation develops, the danger of the ferment action of butyric bacteria would be slight, or absent.

506. **Norway.** *Experiments in the Electric Treatment of Cultivated Plants.* — *The Meddelager fra Norges Landbrukshoiskole* Report of the Superior Agricultural School in Norway, Parts 6, 7, Christiania, 1923, gives a detailed description of the recent researches that have been conducted in Norway with a view of determining the effect of different kinds of electric treatment upon the organic matter of plants. These treatments were applied both in the open, and in warm greenhouses, from 1920-1922. The plant used in all cases was barley, while the electric treatment devised by LEMSTRÖM, NEWMAN, LODGE and JÖRGENSEN was employed.

An increase in the organic matter of perfectly ripe barley was only obtained by the discontinuous electrical tests made in 1921. No increase, or decrease, in the organic matter produced by this cereal was noticed in the other experiments (*Bulletin de l'Office de renseignements agricoles*, Paris, April 1, 1924).

507. **Switzerland.** *Studies and Researches on Stock-Breeding.* — According to the data obtained by the Swiss Peasants' Secretariat at Brugg, the gross returns of agriculture in Switzerland have reached, during the last years, the sum of 1.3 thousand millions of Swiss francs of which about one thousand millions are the annual return derived from cattle. The improvement of cattle breeding is therefore a matter of paramount importance to Switzerland. The degree of improvement attained by the stock-breeding industry is always intimately connected with the development of scientific and practical experimental research on domestic animals. The accuracy of the results obtained from these researches, and hence the value of the conclusion that can be deduced for the guidance of the practical agriculturist, or breeder, naturally depend upon the personal qualifications of the experimentalist, and the care with which the work is carried out. Thus, the results of various tests can only be compared together if all the said tests have been organised, conducted, estimated and examined according to the same principles. An experiment that does not conform to this rule will, in the majority of cases, lead to the formation of erroneous conclusions and therefore be more harmful than helpful to the practical worker. The author explains some rather confused ideas that are current, especially in the case of experiments on cattle, he also describes the various ways in which such researches should be carried out, the chief objects to be aimed at, the best methods to be adopted for different purposes, and finally, points out some of the most common mistakes. Th last chapter is devoted to the organisation of experimental work on live stock in Switzerland and to some of the stock breeding questions of the day. Questions relating to the organisation and the method employed are the most important. The work has been written especially for persons engaged in researches on stock-breeding, but many instructive instances are quoted and the results of experiments dealing with questions of importance to the practical breeder are also given. [Essais et recherches sur l'exploitation et l'entretien du bétail. *Annuaire agricole de la Suisse*, 1923, Part V, Communica-

tion from Dr. A. SCHMID, "Administrateur des Etablissements fédéraux d'essais et d'analyses agricoles, Liebefeldt, Berne).

508. **Rhodesia.** *Government Industrial Schools for Natives.* — Two schools for natives have recently been opened by the Native Developement Department in Mashonaland and Matabeleland. The primary object is to teach the natives to make better use of the potential agricultural wealth of the reserves which have been set aside for them. In addition it is proposed to train a class of native who will eventually assist the European farmer in the handling of unskilled labour which he is often obliged to employ. (G. A. TAYLOR, Inspector of Native Development. *Rhodesia Agricultural Journal*, Vol. XX, No. 4, p. 407. 1923).

509. *A Joint East African Board* has been established in London. The objects of this important body are to bring about co-operation and uniformity as regards administration and policy in Kenya, Nyasaland, Uganda and Tanganyika, and to create a liason between those Colonies and Protectorates and commercial interests in Great Britain. It is not intended that the Board shall in any way supersede the function of any organisation existing for the promotion of special interests (e. g. the Empire Cotton-Growing Corporation, the East African Producers' Association and others). (*Tropical Agriculture*, Vol. I, No. 1, p. 9. Trinidad, 1924).

510. **Great Britain.** *Protection of Nature.* — A meeting of the recently formed Central Correlating Committee for the protection of Nature, was held at the Natural History Museum, London, on March 3rd, 1924. The Societies represented on the committee are : Linnean Society, Royal Society for the Protection of Birds ; Zoological Society ; National Trust ; Society for the Promotion of Nature Reserves ; British Ornithologists' Union ; International Bird Protection Committeee ; Fauna of the Empire

511. *Bird Sanctuaries.* — Quite recently bird sanctuaries have been established : in the London Parks, at Gosforth Park (Newcastle-on-Tyne where the main feature is a lake covering over 30 acres, surrounded almost by woods or trees ; at Roundlay Park (Leeds) ; at Addington (Surrey). The Galson Estate, Lewis of 56 000 acres has been reserved for the ornithological section of the British Museum (Natural History). (See *Bird Notes and News*, No. 1. 1924. London). Another important bird sanctuary has recently been secured off the coast of Northumberland, viz. the Farne Islands a remarkable breeding place for sea birds, Two other reserves exist on the East coast of England : one at Blakeney Point (Norfolk) 1700 acres largely used for migratory birds and another at Scolt Head not far away which comprises some 1200 acres. These are tracts of wild land and seashore and during the breeding seasons watchers are maintained to prevent thoughtless interference with the birds. Wicken Fen near Soham in Cambridgeshire is really an insect reserve, but is used by several of the rarer birds. (*Science*, v. LVI, No. 1523 p. 233, 1924).

512. **Italy.** *National Park at Sila* (*Calabria*). — In the course of the Session of the Commission for the National Park at Sila, which was held at the "Ministero degli Interni" the resolution was passed for the appointment of a Managing Committee for the National Park of Sila. This park completes the series, the other being the "Gran Paradiso" of North Italy and the Park of the Abruzzo in Central Italy. The chief object of the above-mentioned

Committee will be the scientific, aesthetic, turistic and economic development of Regia Silo which is one of the most beautiful parts of Italy.

513. *The Alpine Garden at Madesimo* (Prov. of Sondrio). — Was created in 1920 by the "Associazione Italiana pro piante medicinali, aromatiche ed altre utili". It lies on the Splugen road at an altitude of 1505 m. viz. sufficiently high to allow any alpine species to grow there but not at a height exceeding the limits of arboraceous plants and forest trees. The latter cannot be cultivated at the Chamousie Alpine Garden on the Little St. Bernard owing to the great altitude. The Madesimo Alpine Garden occupies an area of about 1 hectare.

In 1922, 200 alpine species were planted, all of which, including the foreign ones, did well. In 1921 and 1923, twelve plots were set apart for 12 species of forage plants partly with the object of cultivating at high altitudes certain forage crops of the plains that are able to adapt themselves to the mountains, but chiefly in order to collect seed, for its is well-known that the best products are obtained from plants that have become acclimatised in the high mountains. Excellent results as regards development, flowering and yield were given by: *Festuca rubra*, *F. ovina*, *F. pratensis*, *F. duriuscula*, *Alopecurus pratensis*, *Dactylis glomerata*, and *Agrostis stolonifera*. Less good results were obtained from *Phleum pratense*, *Anthoxanthum odoratum* and *Avena elatior*. Of the leguminosae *Anthyllis vulneraria* succeeded the best, it grew more luxuriantly and bore more and finer seeds than when cultivated on the plain, therefore this species is to be recommended for improving the poor pastures of the valleys of the Spluga. *Trifolium rubens* also gave very encouraging results. As regards forest trees, the following were planted: European larch, *Larix* spp. *Larix leptolepis* and *Pinus Strobus* while acclimatisation experiments ahve been begun with other and foreign conifers that might prove useful for afforestation purposes even up to the altitude of 2000 m., viz., *Picea alba* and *Pinus Banksiana*. Strongly-growing seedlings of both these trees and also of *Pinus Engelmanni* are now to be seen in the nursery. (*Bollettino dell'Associazione italiana pro piante medicinali, aromatiche ed altre utili*, Year VI, Nos. 11 and 12, Milan 1923; Year VII, No. 1, 1924.

Exhibitions and Competitions.

514. **Austria.** *International Fair, Vienna, October 7-14, 1924.*

515. **Belgium.** *Exhibition of School Publication, Tirlemont, June 1924.* For further information apply to "Ecole Normal d'Instituteurs" Tirlemont, Belgium.

National and International Exhibition of Novelties for Houses in Town or Country, Keysel Laeken July 15-August 15, 1925. — Organised with the assistance of various Ministerial Departments, Provincial Authorities, Agricultural Societies, etc., the exhibition will be held at the "Institut normal superieur d'économie menagère agricole" of Heysel-Laeken (near Brussels). The exhibits will include: small machines — electrical appliances — products of minor industries — gardening and dairy work — scientific experiments — demonstrations — lists of books — schemes for rural dwellings. There will also be a cinematograph and lectures. All communications to be addressed to M. Lacroix, Commissaire general, 122 Chaussée romaine, Laeken. *International Exhibition of Social Co-operation and Well-Being, Ghent, June 15-September 15, 1924.*

516. **Spain.** *International Sample Fair. Barcelona, May 31-June 10, 1924.* — All communications to be addressed to : Feria Oficial de Muestra, Plaza, Antonio Lopez, Barcelona.

517. **France.** *Paris Fair, May 10-25, 1924 " Second Wine Salon ".* — For further information apply to : Comité des expositions de la Confédération générale des Vignerons, Paris.

Exhibition of the Latin Countries and their Colonies, Toulouse, June 1-October 15, 1924. — The exhibits well include all the products of industry, commerce, agriculture and science as well as all matters relating to teaching, social economy, history, tourists and gymnastics.

Central Exhibition of Breeding-Stock (Horses and Donkeys), Paris, July 2-6, 1924. — Inaugurated by the Ministry of Agriculture, Direction of the " Haras " (Stud-Stations). Open to animals foaled in France.

Modern Village Competition. — Inaugurated by the " Office régional agricole du Midi ". 6 Rue Saint Jacques, Marseilles. Prizes will be awarded to the 12 departments of the Southern region that have made most progress in the organisation of the public and hygienic Services (Water-supply, lighting, distribution of power in agricultural farms, public buildings, markets, schools, postal services, libraries etc.).

518. **Italy.** *International Motor-Vehicle Exhibition, Turin, May-June, 1924.*

Sixth International Sample Fair, Padua, June 5-19, 1924.

519. **Lettonia.** *Fourth Agricultural Industrial Exhibition, Riga, July 20-August 3, 1924.*

520. **Holland.** *The People's Food Exhibition, Amsterdam September 11-18, 1924.* — For further information apply to : the " Secretariat of the Executive Committee, Weekblad " Volksvoeding ", Groenburgval, 44, Amsterdam.

521. **Kingdom of Serbs, Croats, and Slovians.** *Fourth Annual Sample Fair, Lubiana, August 15-25, 1924.*

First Industrial and Agricultural Sample Fair Belgrade, September 1924. — This is an international fair.

522. **Russia.** *Nijni Novgorod Fair, August 15, 1924.*

523. **Sweden.** *Sixth Swedish Annual Commercial Fair Malmö, August 1-7, 1924.*

Swedish Industrial Fair, Gothenburg, August 3-9, 1924.

524. **Switzerland.** *Swiss Industrial Fair, Lausanne, September 13-28, 1924.*

Congresses.

525 **North Africa, Tunisia.** *Congress of Tunisian Agriculture, Tunis, April 1924.* — Organised by the former students of the Colonial Agricultural School of Tunisia under the patronage of the Resident-General of France. For further information apply to : M. Charles Coupin, 9, Rue de Grèce, Tunis.

526. **Austria.** *XVI Conference of Fishermen in German Austria, Graz, June 1924.* — Information may be obtained from " Sekretariat der Deutsch-österreichischen Fischerei-Gesellschaft ", Wien, Elisabethstr., 224.

527. **Spain.** *International Congress of Home Education, Madrid, Spring of 1925.* — Apply to Secretary General, Vizconde de San Antonio, 5, Calle del General Orda, Madrid.

528. **United States.** *International Congress of Automobile Transport, Detroit (Michigan), May 21-24, 1924.* — Organised by the National Automobile Chaber of Commerce of Detroit.

529. **Italy.** *Congress of the National Union of the Travelling Professors of Agriculture, Rome, May 10, 1924.* — Subjects dealt with: L. PETRI. The Present Condition of Certain Phytopathological Problems. — U. PRATOLONGO. Fertilisers and Correctives in the Treatment of Soils with Normal Reaction. — E. FILENI, Provincial Agricultural Councils. — G. MORASSUTTI, The Organisation of Production in Relation to the Market Price of the Products and the Special Work of the Travelling Professors. For further information apply to: Unione Nazionale delle Cattedre Ambulanti d'Agricultura, Rome, 115 Piazza Montecitorio.

National Congress of Industrial Chemistry, Milan, April 13-16, 1924. — For further information apply to: Società di Chimica, Milan (3), 16, Via San Paolo.

Eighth Congress of Italian Apiculturists, Bologna, Autumn of 1924. — All communications to be addressed to: Comitato Nazionale Permanente pei Congressi degli Apicoltori Italiani, Lanciano (Abruzzi).

530. **Peru.** *The Third Pan-American Scientific Congress* will meet in November, 1924, at Lima, Peru. — This will be the first meeting since the War, and a large attendance is expected from the United States and Canada, as well as from Latin America. The previous Congresses met in Santiago, Chile, in 1908 and in Washington in 1915. The last Congress was divided into nine sections and practically all branches of science were represented.

Miscellaneous.

531. *Adoption of the metric system in Persia.* — The Council of Ministers has recently approved a Bill, proposed by the Ministry of Public Works, for the uniform adoption of the metric system of weights and measures throughout the country. (*The Board of Trade Journal*, London, March 27, 1924.)

532. *The fixation of nitrogen.* — Through scientific work at the Fixed Nitrogen Research Laboratory of the U. S. Department of Agriculture (director Dr. F. G. COTTRELL), in Washington, a catalytic substance has been developed that brings about the fastest known reactions between hydrogen gas and nitrogen gas to form ammonia. The research work has been carried on under the direction of Dr. A. T. LARSON. The new catalyst is made of iron oxide, aluminium oxide and potassium oxide; its cost is very low. At a pressure of 1000 atmospheres, 90 per cent. conversion has been obtained with the new catalyst; therefore it gives yields at least twice as high as the best catalyst now known. The United States nitrate plant N. 1 at Sheffield, Alabama, was designed for a process that can use this new iron catalyst.

Although over 30 per cent. of the nitrogen produced in the world is now supplied by fixation of atmospheric nitrogen, less than 1 % of America's present requirements are supplied by atmospheric nitrogen fixed within the United States. Only one commercial plant, located at Syracuse, N. Y., is operating that uses the synthetic ammonia process, and the catalyst used there is being kept a secret. The government plant at Muscle Shoals, now idle, has a ca-

pacity only one fifth of the 200 000 tons consumed in the United States and the present time ; this plant employs the cyanamide process. (*Science*, v. LIX, n. 1523, p. X, New York, 1924).

533. *Transformation of ammonia into fertilisers by the* G. CLAUDE *method.* — A nitrogenous and potassic fertiliser is obtained by substituting for common salt (in the manufacture of sodium carbonate) Alsatian Silvinite (chlorides of potassium and sodium). The action of the ammonia and the carbon dioxide causes the sodium to be precipitated in the form of a bicarbonate leaving behind the mother liquors of the potassium chloride and the ammonium chloride which can be extracted by lowering the temperature. In this manner, by combining the industries of soda and ammonia a good fertiliser can be made with out leaving waste products.

534. *Changes occurring in air-dried vegetable soil.* — The number of bacteria in air-dried vegetable soil is decreased by three-quarters, but desiccation produces modifications in the chemical composition when different solvents are used : water, acetic acid, oxalic acid, nitric acid. Ammoniacal nitrogen increases the number of micro-organisms. (A. LEBEDIANTZEFF, *Comptes Rendus de l'Académie des Sciences*, Paris, Session of March 10, 1924).

535. *The elementary forms of the component parts of plants, or the origin of Species.* — This question has been studied by Dr. G. E. ANASTASIA, who has made numerous and minute researches on *Nicotiana* (experimental reconstruction of *N. Tabacum* by means of *N. rustica* and *Petunia*, the extreme forms of the species included in the genus) as well as analysing some species of the Primulaceae and especially those of the genus *Primula*. From this work together with his analysis of the species composing the genus *Viola* he arrived at the conclusion that " the species included in each of the above groups are compounds produced as a result of various combinations (in number and quantity) of the same primordial elements ". It is permissible to suppose that " this has been the true generative process of all living species to whatever family they may belong ". The researches of the author have clearly proved that the essential characters of the species are its complexity and its variability (in opposition to the fixity of species believed after LINNAEUS, although the theory had already been undetermined by the discovery of mutation). Hence mutation is no longer in the words of DE VRIES, " A hidden inexplicable fact ", but rather a consequence of the complex nature of plants. (*Bollettino tecnico del R. Istituto sperimentale per le coltivazioni dei Tabacchi*, Scafati, Year XIX, Nos. 1 and 3-4, and XX, No. 1).

536. *Imitation of protoplasm and chromosomes.* — LEDUC has imitated mitosis and chromosomes by means of Indian ink mixed with salt solutions. HERRERA has obtained nuclear figures in relief that were fixed without difficulty by sprinkling over a piece of white cardboard a mixture composed of : almost solid commercial sodium silicate 150 gm. + distilled water 200 gm. + ivory black 10 gm. and then sprinkling over it some drops of a dehydrating liquid such as absolute alcohol. Every drop produces a diffusion field, endocellular currents, co-agulates and the appearance of pseudo nuclei and macroscopic chromosomes which on drying remain attached to the cardboard. If an inorganic colloid (silica) is used it is possible to reproduce the appearance of protoplasm, nuclei, chromosomes, mitosis, etc. It is necessary to remember the existence of

inorganic colloids in studying the problem of the appearance of life (*Atti della R. Accademia dei Lincei*, Rome, Vol. XXXII, No. 9, pp. 508-510).

537. *Coagulation and plant life.* — The lowering of the superficial tension of the colloidal medium by promoting coagulation stops osmotic interchange. M. J. AMAR has studied the action of this important biological factor in starch, seeds and leaves. (*Comptes Rendus de l'Académie des Sciences*, Paris, Session of April 7, 1924.

538. *New method of estimating hydrocyanic acid in plants.* — The plant is reduced to powder, some water is added and the mixture left to hydrolise for 4 hours in a stove at 37°C or for 20 hours at ordinary temperature. The hydrocyanic acid is then driven off at low temperature by a current of air and collected in a solution of potash and then estimated with iodine (KOHN-ABREST and J. RICARDINI (*Comptes Rendus de l'Académie des Sciences*, Paris, Vol. 177, No. 17).

539. *The levuloses in cereals.* — H. COLIN and C. BELVAL have discovered the presence of levuloses, especially in the scarcely-formed grains, levigyrous elements which make up as much as 40 % of the dry matter; a small amount of levosine is present in the ripe caryopsides and in the flour, and to a less extent in wheat and barley. In oats, there is a little levulose in the green culms and the grains that are in process of formation; the levigyrous elements are completely reabsorbed at harvest-time, so that none are ever present in the flour. Maize and buckwheat never contain levuloses at any period of their growth. These reactions can be applied in the analysis of mixtures of flour. (*Comptes Rendus de l'Académie des Sciences*, Paris, Vol. 177, No. 20, pp. 972-975).

540. *A new crystalline chromogen, esculetol, extracted from the horse-chestnut.* — G. BERTRAND and Y. DJORITCH have succeeded in separating in a pure and crystalline condition the substance present in solution in the integuments of the young fruits and also in the still green integuments of fully-developed fruits as well as in the cortex of young branches of *Aesculus Hippocastanum*. This substance is colourless as long as it remains enclosed in the living cell, but rapidly turns dark yellow when as a result of a lesion of the tissues it is exposed and comes in contact with the air. The authors were able to discover that this change of colour due to the laccase which is associated with the esculetol in the plant. (*Comptes Rendus de l'Académie des Sciences*, Paris, April 7, 1924).

541. *Plant Views.* — The vascular bundles of plants not only carry raw food material from the roots to the leaves, but also transport the "chemical messengers" which take the place of nerve impulses in the nerves of animals. In both cases a stimulus given to one part of the body often causes a reaction in a different part. The stimulus is sent through some plants at a rate of 10 to 20 millimeters per second; it is probably conveyed by "chemical messengers" or "hormones" liberated by the stimulated part into the transpiration stream. In prof. H. H. DIXON's words: "Whatever the intimate mechanism of the system is, the subject of the transmission of stimuli through plant tissues offers a striking example of the swing of the scientific pendulum of scientific opinion. The view based upon superficial resemblances, that the vascular bundles are the nerves of plants, was long abandoned, but now we see there is clear evidence that they actually transmit stimuli from the sensory to the motor regions, and so perform the functions of nerves. Naturally, there are very great differ-

ences in detail between the modes of action in the two cases. (*Science*, vol. LIX,No. 1523, p. XI-XII, New York, 1924).

542. *The mechanism of the germination of wheat in sheaves as a result of ain rduring or after harvest.* — Prof. O. MUNERATI undertook the task of determining whether, and to what extent, the low temperatures accompanying the rain storms at the end of June, or the beginning of July, were responsible for the more or less severe injury caused by the sprouting of the grain in the sheaves when the harvesting and stooking had been hindered and delayed by rain. The observations of the author showed that : 1) the germination of stooked wheat (or of cereals of similar behaviour) when the harvesting or other operations preceding threshing are disturbed by rain is chiefly due to the rapid fall in temperature accompanying summer storms which are nearly always violent ; 2) the low temperatures accompanying the rain at this season not only do not inhibit germination but are even the determining cause promoting it ; 3) therefore, the probability of injury to the crop is greater the longer the fluctuations of temperature continue after the rain, and is, on the contrary less, the sooner the temperature reaches the normal maximum ; 4) some varieties are extremely susceptible to untimely rain (this has proved to be the case with turgid wheats) while others offer more or less resistance (of the wheats tested " Carlotta Strampelli " proved always the most resistant). If a study were made, in every given case, it would be possible to discover the most susceptible of the local types and to find out the best means of preventing or lessening the injury (by early stooking and threshing etc). (*Atti della R. Accademia dei Lincei*, Rome, Vol. XXXII, Parts 1-2, pp. 35-36).

543. *" Chamaerops humilis " as a paper-plant.* — The utilisation for paper-making of the dwarf palm (that invades certain sea-shores of North Africa rendering them useless for agriculture) would be an excellent means of exploiting the plant regularly or even of eradicating it. Dr. LENZ has found that, by means of the soda treatment, 35 % of unbleached pulp can be obtained from this palm. The leaves and leaf-sheaths contain 23% of cellulose and the stem contains 14 %. (*L'agronomie coloniale*, Year 9, No. 72, p. 186, Paris).

544. *Alfa, a raw material for paper-pulp.* — North Africa is still the country that produces most of this Graminiacea which is continually being more widely employed for making paper pulp. Before the War, Algeria exported annually about 1 500 000 tons of raw alfa. In 1913 England absorbed 93 % of the total production, the rest being divided amongst Spain (40 000 tons), Belgium (18 000 tons) and France (800 tons), Portugal and Italy. In Tunisia supplied 400 000 tons to France and 45 000 tons to England. During the War, the exports fell considerably and factories for making paper-pulp from alfa were built on the spot ; there are now in full working order. (*Revue scientifique*, Year 62, No. 7, p. 261, Paris, 1924).

545. *Transport of hevea latex.* — The technique of rubber preparation has recently been altered in a manner to greatly improve the final product. In the first place we may mention the HOPKINSON method which has already been widely adopted. This is based on the use of latex transported uncoagulated from the plantation ; this unworked latex is chiefly sent to the United States. It is precipitated in a room heated to 95°C. which causes the rubber to be

deposited in the form of a very light white and absolutely pure powder of a quality superior to any prepared by coagulation on the plantation.

The Dollar Line which has been recently started in the United States organises the sea-transport of latex from Batavia, Singapore, Penang and Colombo to New York.

The first large consignment of this latex arrived in New York towards the end of 1922 and consisted of a cargo of some 3000 hectolitres despatched for the General Rubber Co. in a tank-ship. The latex came from the society's estate at Sumatra; it kept very well during the voyage and on arrival was pumped out without any difficulty.

The latex was sent in petroleum tins from British Malaya. In 1922 the Sumatra plantations furnished about 7000 hectolitres and in the first half of 1923 British Malaya sent over 4000 hectolitres of latex to the United States. Its carriage presents no difficulties. Thus the product forwarded from Sumatra is preserved by means of an anti-coagulant (ammonia, caustic soda, or formaldehyde etc.) and transport by rail in tank-trucks from Delhi to Belawan where it is stored in floating cisterns from which it can be pumped into the tanks of the steamers. (*L'Agronomie coloniale*, Year 10, No. 74, pp. 49-50, Paris, 1924).

546. *Camphor cultivation in Romagna.* — As a result of the efforts of the "Consorzio industriale agrario" of Cesena and of various Committees and local Public Bodies, foundations have been laid for planting camphor on a large scale in Romagna with the object of assisting the development of the celluloid and nitrocellulose industries. (*Bollettino dell'Associazione italiana pro piante medicinali, aromatiche ed altre utili*, Year VI, No. 91, p. 166).

547. *A new commercial method of tea adulteration* has been reported by Prof. U. Brizi. It consists in wholly replacing the tea leaves by the leaves of *Osmanthus fragrans* a native of Japan and China and grown as an ornamental plant on the whole Mediterranean coast. The sample examined by the author came from Marseilles and from its external characters would have been taken as a sample of the best Japanese tea. It was found on analysis to contain water 8.5 %, ash 6.40 %, substances soluble in boiling water 32 %, tannin 22 %, traces of caffein. The adulteration could be detected by microscopic examination from the structure of the leaves which is very different from that of tea leaves. The substitution was probably effected in Japan where the flowers of *B. fragrans* are frequently mixed with inferior teas in order to improve the aroma. This species is one of sixty others whose leaves are said to be introduced in the adulteration of tea. (*Bollettino dell'Associazione italiana pro piante medicinali, aromatiche ed altre utili*, Year VII, No. 2, Milan, 1924).

548. *Exportation of pepper.* — The amount of pepper exported in 1922 from the chief pepper-producing countries was (in round numbers) British India 58 000 quintals; British Possessions 213 000 quintals; Malay States 223 000 quintals; Dutch Indies 120 000 quintals; Indo-China 31 000 quintals; Siam 8 000 quintals. Thus the exports from the French Colonies (chiefly Indo-China, although in 1921 Madagascar shipped 21 quintals) would be almost sufficient to meet the pepper requirements of France which in 1921-23

amounted on an average to 33 420 quintals per annum. (*L'Agronomie coloniale*, Year 10, No. 74, pp. 50-52, Paris, 1924).

549. *Essential oil of peppermint extracted from peppermint water.* — While engaged in controlling the yield of the peppermint distillery (at Pancanlieri, province of Turin, in August 1923) Dr. V. MASSERA found that in order to obtain 1 kg. of essential oil about 400 kg. of the plant were required while some 150 litres of water of distillation was produced. Hitherto this water was regarded as a waste product for it was never re-distilled for fear of imparting a bitter flavour to the essential oil. The author however, tried extracting the essential oil by means of benzol and obtained from this water of distillation a product which on analysis proved to be of good quality and very rich in menthol (57.59 % being the average of 2 tests) but, the return was too low, on an average 9 % (the loss as a solvent is marked, 0.06%) to make the recovery of the essential oil worth while. (*Bollettino dell'Associazione italiana pro piante medicinali, aromatiche ed altre utili*, Year VI, No. 11, pp. 200-201).

550. ***The medicinal use of the bark of "Prunus Cecumilia"*** has been reported by Prof. A. TROTTER. Although the medicinal properties of the bark of *Prunus Spinosa, Pr. Padus, Pr. Cerasus, Pr. Serotina* Ehrh. have long been known and the bark of these trees was recognised to have a tonic-astringent, sedative narcotic, and especially a febrifuge action and was used occasionally for various purposes, as is mentioned by some recent authors, the curative properties of *Pr. Cocumilia* ten, a native of South Italy appear to have been forgotten, although its action as a febrifuge especially in the case of intermittent fevers is more marked than that of the allied forms. Its use in medicine seems to have originated in Calabria about the end of the eighteenth century. (*Bollettino dell'Associazione italiana pro piante medicinali, aromatiche ed altre utili*, Year VI, No. 12, pp. 220-222).

551. *Equisetum arvense, a weed that can be used in the home Pharmacopeia.* — The old herbalist and some of their modern followers, of whom one is KNEIPP, recommend this plant for its medicinal properties. The sterile stems, if gathered in summer, dried in the sun, or an oven, and kept very dry in bags are said to be useful as an infusion to cleanse the stomach, but must only be taken occasionally. They can be employed, in addition to steam baths, in cases of kidney trouble or of retention of urine. In cases of haemorrhage, or effusion of blood, a decoction of these stems should be taken at once. (M. FIORAVANTI, *Bollettino dell'Associazione italiana pro piante medicinali, aromatiche ed altre utili*, Year VII, No. 1, p. 9, Milan, 1924).

552. *Early forcing method.* — The methods most generally adopted in order to arouse plants especially flowering species, prematurely from their winter sleep are the ether method of JOHANNSEN and the hot water bath of MOLISCH. Recently, WEBER has suggested crushing the dormant buds (with pincers) while RICHTER proposes their immersion for a few seconds in concentrated sulphuric acid after which they must be carefully washed several times. Plants after their buds have been crushed, or burnt by acid, react energetically to the lesion as soon as they are put into a warm room and flower at once. In 1922, WEBER proposed Röntgen ray treatment for the same purpose. KIELES advocated baths of electric light. Another process is the following; dissolve 30 gm. of sugar in 0.5 litre of water and add 20 gm. of fresh yeast:

bathe in this mixture for 24 hours branches of lilac or *Forsythia* then take them into a warm room and put the ends of the branches into water, after which the buds will soon open and flower. (" Methoden des Frhtreibens ". *Abderhaldens Handbuch biolog. Arbeitsmethoden*, 1922 ; *Berichte der deutschen botanischen Gesellschaft* Vol. 40, 1922 ; *Die Umschau*, Part 3, Frankfurt a M., 1924).

553. *Forcing vegetables on the Plain of Albenga (prov. of Genoa).* — The Plain of Albenga is the most extensive plain of Liguria, but until twenty years ago it was a vast marsh on the highest points of which hemp alone was cultivated. Now, however, it has been completely drained and the water is used for irrigation, so that it has become a centre of intensive production of vegetables (chiefly during the winter) and also of fruit. The vegetable chiefly grown is asparagus which is cultivated in an original manner, generally under glass, being forced with stable-manure, or preferably, cotton waste. This latter substance is the more expensive but it forces the plant very quickly and therefore leaves a larger margin of profit. The method of asparagus cultivation, as practised in the Albenga district, is described in detail by Prof. D. ALLEGRI in *Giornale di Agricoltura della Domenica* di Piacenza, No. 10, 1924.

554. *The globe artichoke of the Roman Campagna* retains its advantages (more tender and savoury), even when growing out of its natural environment, as has been discovered by Signor E. PETROBELLI at Lendinara (prov. of Rovigo). It appears to be more subject to the attacks of mice than other less improved varieties such as the " Comune di Chioggia ". (*Il Coltivatore*, Year 70, No. 10, p. 297, Casale Monf., 1924).

555. *The fertilising agents of the apricot* are, according to Prof. A. MANARESI, in the first instance, hymenoptera especially bees ; the macroglossa amongst the moths and then in descending order, diptera of the *Syrphidae* and coleopteron ; most of the above perform the same office in the case of the peach. (*Rivista di Biologia*, Vol. V, Part VI).

556. *Intensive vine cultivation in Bas-Languedoc.* — E. M. ROGER (a well-known wine-grower of Vaumage Nimes) summarises in the title of his book his chief principle viz., " the prosperity of the vineyard of Southern France depends upon the conservation of the water in the soil, to a far greater extent than upon the amount or composition of the fertilisers applied ". In his work, the author described the intensive method of vine-cultivation that he has devised and used with excellent results in his own vineyards. He quotes at length from scientific works containing the theoretic basis of this method thus explaining its success. The author has evidently written with a view to propaganda in order that all may profit from his work and experience, for he enters into the all minute technical details. The method was devised for the Mediterranean regions with the hottest and driest summers ; it is based on the following principles : 1) the soil water must be stored up and retained as long as possible ; 2) this can only be done by means of surface work carried on throughout the year ; 3) in order to be able to work the soil during the entire season, the foliage must not lie on the ground and the paths between the rows must be free, which necessitates the vines being trained on trellises and along wires ; 4) training the vines along wires allows of the pruning the long canes of one years growth which is the only means of obtaining heavy and regular crops and of allowing

the vine to profit by its natural advantages ; 5) this chain is one of which no link must be wanting, as otherwise the results are entirely different.

In order to carry out many superficial workings (every 8-10 days), suitable apparatus must always be at hand in the vineyards. The anticryptoganic treatments are carried out on a large scale and as quickly as possible. Owing to the long pruning and the heavy crop, the vintage is delayed 15 days. The amount of fertilisers used is small, for 15 years following the vines were only manured with wool waste furnishing 45 kg. of nitrogen per hectare. The average wine production for the 17 years 1907-1923 was 140 hectolitres per hectare as against 60 hectolitres per hectare in the other Communes of Vaumage. The alcohol content of the wines (both red and white) is at least equal to that of the average found in the wines of the same type in that region. The author estimates the cost of wine production by his method at 35.70 fr. as against 50 fr. in the case of the method usually adopted in Vaumage (training in little bushes, in vase-form). (*La Goutte d'Eau, Culture intensive de la vigne dans le Bas-Languedoc*, 16°, pp. XVI-528, figs., tables 26 separate from text).

557. *Grapes as a remedy.* — According to Dr Ed. CRONZEL, 1 kg. of perfectly ripe grapes eaten fasting every morning soon disinfect the faeces and cure flatulence due to infection. Both the skins and pips must be swallowed ; care, however, should be taken to masticate the latter. (*Le Progrès agricole et viticole*, Vol. LXXXI, No. 13, p. 297, Montpellier, 1924).

558. *Living supports for vines.* — Signor A. ZAPPI-RECORDATI reviews all the various living supports for vines that are used in different parts of Italy and makes some brief remarks upon each and upon the local conditions determining their choice, as regards environment and the form in which the vines are grown. He examines : the Common Maple (*Acer campestris*) which is most generally used and succeeds in all soils, except those that are too damp, too dry, or very compact ; *Celtis austral* and *C. occidentalis*, the author places with the Maple as superior to any other plants for the purpose ; the Common Ash (*Fraxinus excelsior*) that like the elm and poplar ought to be discarded since they have superficial roots and thus exhaust the ground ; the Manna-Ash (*Fraxinus ornus*) a tree that thrives on stony, sterile soils ; willow (*Salix alba*) ; Black Poplar (*Populus nigra*), Oak (*Quercus Robur*) all very little suited for supports for the vine ; *Quercis Cervis* ; elm (*Ulmus campestris*), Common Alder (*Alnus glutinosa*) all of which do well on siliceous clays ; Cornel (*Cornus-mascula*) that grows on any soil and in any exposure. All these trees have leaves that can be used for stock-feeding.

In his " Lezioni orali "' BIDOLFI advises fruit-trees being employed as supports for the vine. His suggestion has, however, not been adopted by growers on a large scale but finds favour with smaller cultivators, thus in some of the districts near Bologna, the vines producing table-grapes are usually trained on rows of fruit-trees amongst which predominate, plum-trees, cherry-trees, pear-trees, almond-trees, apricot-trees apples-trees, etc. In the district of Imola and in other parts, it is very common to find at the end of the rows, and on the pillars in the centre, walnuts, apples and rarely, pears.

Amongst the fruit-trees upon which vines can be trained, the following deserve mention : apple (*Pyrus malus*) the commonest ; pear (*Pyrus communis*) growing well on poor soil ; walnut (*Juglans nigra*) much used formerly in the

districts of Ferrara and Veneto, though it gives too much shade which is bad for the vine and for the soil; bird-cherry (*Prunus avium*) which does not cast too much shade, the mulberry (*Morus alba*) very much used in Emilia where it is the favourite tree for growing in rows near high-roads, on the borders of fields, as well as at the head of rows, on pillars, etc. If the mulberry is used as a support for the vine, two valuable crops can be obtained, but as according to the old system, the vines were too much shaded, CASTALDIS has adopted a new plan. The mulberry is grown somewhat in pyramidal form (instead of in vase-shape) and the vines are grown at some distance from the tree by which the fruit-bearing branches of the vine are supported. The CASTALDIS method has been adopted by many practical vine-growers of Veneto and Friuli who consider it most successful. In Genoa, since remote antiquity, vines have been trained on fruit-trees and olive-trees, the association in the latter case lasting for about 35 years, viz., until the vine is old and the olive-tree begins to bear well.

In conclusion, the author describes the manner of raising these living supports, especially those employed in Emilia, and the formation in which they are planted. (*Giornale vinicolo italiano di Casale Monferrato*, Year 47, No. 48; year 48, Nos. 3 and 4).

559. *New and valuable Graganoci hybrids.* — Signor A. PIROVANO mentions some hybrids he has obtained at Vaprio d'Adda (prov. of Milan) by crossing the vine "Graganoci" or "Greco bianco" (noted for its almost complete resistance to peronospora) or Pirovano "16" or "I P. 17" (obtained in 1902 from pollinating Grecanico with "Precoce d'Ischia" and hence resistant to phylloxera even when grown on its own roots though it is of pure European descent) on the one side with Siebel 2052, Siebel 60, Siebel 1077 and Castel 15602 on the other. By selecting the hybrids obtained, which included many good types, the author entirely neglected the question of phylloxera resistance which can always be insured by grafting, and only aimed at hardiness, the highest sugar content and unexceptional flavour. In the article examined, he describes briefly the progeny obtained: two selected forms are already on the market: "Precursore" (Siebel 60 × I P. 17) which is unusually early in ripening, and "Colosso" (Grecanico bianco × Siebel 1077) with a wonderfully heavy yield, both with clean flavour and resistant to disease (*Rivista di Ampelografia*, Year VI, No. 9).

560. *Protection of vines from frost.* — The best way of protecting vines from frost is, as E. CHIMIENTI states, to lay them down and cover them with soil before the winter cold sets in, and then to train them on trees, for at some metres above the ground, the air is warmer than on the level of the soil. In Piacentino, and in Cremona to some extent it is the custom to bury the vines in this manner; they are trained on a dead trunk or on living trees and fairly low down. Since the vine to be buried cannot be stretched along the ground the cordon form with low stock or trained on a tree is chosen, pyramid and tree forms being avoided. In Piedmont and Veneto the vines supported by stakes are bound 4-5 together with very long trailing branches and covered with soil; sometimes the branches, while attached to the stakes, are covered with bunches of straw, or else the vines are untied from their supports. In the plain of Alexandria, the vines are extended on the soil and covered with

5 cm. of soil, with the exception of the ends of the branches, which remain exposed. When the stock cannot be bent, it is covered up with soil and the branches are roughly pruned and buried as above described. In France short pruning has hitherto been the rule, but the cultivation of free-growing vines with a strong root-system is now gaining ground. In the case of vines grown according to the Gujot system, it is only necessary, in order to be able to bury them, to cut back the fruiting branches in the autumn, loosen the woody branches from their support, whether a stake or wire, tie them up in a bunch and then lay them on the ground and cover them with soil. When all danger of frost is past, the unnecessary branches are removed and the others attached to their supports. Some persons state that removing the leaves from the stock provents rapid thawing and therefore they train the vines on supports, but no accurate information exists on this subject.

In the case of vines growing on the plain, ditching and drainage operations afford a good protection, but they must be regarded as supplementary to covering the vines with soil.

The author lays stress on the necessity of experimental research on the protection of vines from inclement weather. (*Giornale vinicolo italiano*, Year 48, No. 9).

561. *Experiments in treating surra in horses with "Bayer 205" in the Dutch Indies*, (1). — Surra in horses which is a disease occurring in India and in other Asiatic countries and due as is well-known, to trypanosomes. It cannot be cured, when once it has declared itself, by "Bayer 205" even if large doses are given. Horses treated with this remedy show serious toxic symptoms urticaria, severe dermatitis, pododermatitis, stomatitis, etc., and rapidly lose flesh. Even small doses of "Bayer 205" produce pododermatitis with the formation of rings, from the number and position of which it is possible to determine the number and age of the injections. Even 14 days after the disease has appeared, treatment with "Bayer 205" is quite useless; it is also without effect in cases of relapse. It can, however, be used as a prophylactic (10.6 gm. being given per 100 kg. live weight). RODENWALDT and DONWED; "Bayer 205 bei der Surra des Pferdes in Niederländisch-Indien" *Monatshefte für praktische Tierheilkunde*, Year XXXIV, Parts 10-12, p. 363, Stuttgart, 1924).

562. *Serotherapy against glanders in horses.* — The immunisation of horses against the streptococcus of SCHUTZ is rendered difficult on account of the frequent accidents occurring during the process. In order to prevent these, BROCQ-ROUSSEAU, FARGEOT and URBAIN have tried to obtain an active serum, using bacteria killed with ether-alcohol as an antigene. They associated with this dead antigene a living antigene of glanders streptococci from an agar-agar culture. First, the antigenes killed with ether-alcohol were injected for 10 days in succession, then during the next month, the ether alcohol antigene was injected alternately with living streptococci that had been weakened by heat, in order to prepare the way for the injection of a living unattenuated culture. (*Comptes-Rendus de l'Académie des Sciences*, Paris, Vol. 17, No. 18.

563. *Action of "Cuprex" on the ectoparasite of the dog and the fowl.* — Dr. A. SCHULER has tested "Cuprex" a preparation made by Dr. W. EICH-

(1) See *R.* 1924, No. 261. (*Ed.*)

mol of the " Chemische Fabrik E. Merch ". It is a solution of a copper compound in an organic solvent. " Cuprex " answers all the requirements of an anti-parasite ; when sprinkled, or dusted under the coat or plumage, it kills all the living parasites, but in order to destroy their eggs, it is necessary to apply the cuprex a second time after an interval of 9-10 days. (*Monatshefte für Tierheilkunde*, Year XXXIV, Parts 10-12, pp. 309-359, figs. 9).

564. *Experimental infection of Galleria mellonella with Glaucoma performis.* — A. LEVOFF has inoculated into the blood of the larvae of *Galleria mellonella* a culture of the infusorium *Glaucoma performis*. The larvae thus treated died in 8-15 days according to the number of infusoria introduced which multiply quickly in the blood. Shortly before the death of the larvae, the blood is free from leucocytes (which are numerous under normal conditions) but contains a large quantity of *Glaucoma performis* which completely infest the bodies of the larvae. (*Comptes Rendus de l'Académie des Sciences*, Paris, Vol. 187, No. 13, 1924).

565. *Biological study of growth with special application to domestic animals.* — This study which has been made by A. GÄRTNER is divided into six chapters : Conditions of animal development — Differences between the development of plants and animals — Phenomena of animal growth — Analytic representation of animal growth — Laws of growth. According to the author, " growth in the general sense is the capacity of living substances for producing other living matter ", whereas " growth in the more restricted sense is the capacity of living substance for making living protoplasm from the dead elements of the metabolism of matter especially during the development of the young individual ".

The condition necessary for growth is the interchange of substances dependent on a series of internal factors such as presence of living matter ; adequate cooperation of all the chemical and physical functions of protoplasm and of the all nucleus ; the action of the determinants of the hereditary conditions of growth, etc., and also on a series of external factors such as nutrition, atmospheric condition, temperature, pressure, etc.

The fundamental difference between the growth of plants and animals consists in the fact that the chemical energy present in the food of animals must first be produced by the plant by means of a given transformation of energy.

In the study of the phenomena of animal growth, the author refers especially to the domestic steer and considers : 1) the intrauterine period ; 2) the extrauterine period ; 3) normal and abnormal development. According to the studies of RUBNER, the energy transformation in intrauterine life is 0.7 % of that occurring under normal conditions in extrauterine life ; in order for the foetus to gain 1 kg. in weight it is necessary to have 2038 large calories for the horse, 1913 for the ox, 2029 for the sheep, 2210 for the pig and 2318 for the dog.

The suckling period alone is of essential importance for extrauterine growth. The author refers to some of his observations respecting the suckling of calves (Black Pied Friesians) when teat-reared or bottle-fed. By the latter means even better results were obtained than when the animal was suckled by its dam ; this is due to the hygienic precautions taken in artificial feeding.

During suckling, the great weight increase and the best use of the food is

made. On measuring the milk consumed by 43 calves and the increase in weight of the animals during the first and second months, the author found that during the second month some of the calves consumed, per kg. increase of live-weight, five times the amount of milk they consumed during the first month. Further, he noticed very large individual variations in the nutritive returns: from 3.8 to 28.4 kg. of milk per kg. of increase in live-weight in the first month; from 10 to 28 kg. in the second.

After a sufficient period of suckling, movement in the open air (grazing) is the most important, factor in the growth of young animals.

Increase in weight and increase in volume do not proceed " pari passu ", the first takes place especially during the first month of life, whereas the latter occurs especially in the second month. With the attainment of sexual maturity, increase in volume stops or nearly ceases as a rule, while increase in weight slows down abruptly.

According to RUBNER, if we take 100 as the maintenance ration, 189 % is needed to produce normal growth in the horse; 221 % in the ox and sheep; 222 % in the pig.

Growth can only be estimated by measuring and weighing, for neither operation alone can show the actual growth viz., the amount of newly-formed living substance. There are no chemical processes by which the estimate can be made.

In order to obtain an analytic determination which should give the growth as accurately as possible, RUBNER considered the time necessary for an animal to double its weight. As a rule, the increase in weight ceases (in young animals that are being reared) after the fifth doubling of the weight; the rapidity with which the successive doublings of weight occur give a clear idea of the rate of development. The first period of doubled weight is 60 days for horses — 47 for cattle — 15 for sheep — 14 for swine — 6 for rabbits. In all these animals, the amount of energy used during the period of the first doubling of weight, for interchange of matter and growth was the same: the estimates showed that to double the weight by 1 kg., 4513 calories were required for the horse, 4243 for cattle, 3986 for sheep and 3754 for swine.

From the Pedigree Book of a Breeding-Station for selected cattle in Bavaria, the author found the following averages for 14 calves: time required for first doubling of weight 39 days; for the second 74; for the third 161.

Insufficient feeding may lengthen these periods, but liberal feeding cannot shorten them although the weight increases owing to fat-formation. The utilisation quotient of energy decreases and the time necessary for doubling the weight increases at every successive doubling of the weight.

The author obtained as averages for 65 calves: increases in live weight after one month from birth 63-55 %; after 2-3-4-5-6 months respectively 29.05 — 22.68 — 11.68 — 13.39 — 13.94 %.

The growth curve (age on abscissae, weight on ordinates is similar (ad *S*) for all the animals.

Laws of growth. — Starting from the principle that the amount of growth is in the first place determined by the size of the growing body, O. SCHUPP has expressed the growth curve by the formula $y = y_0 c^t$, where y is the size

of the individual at the time t; y_0 is the size at time ϕ, and c is a constant factor and t the time.

The formula suggested by V. H. BLACKMANN (1919) is of the same type: $W_1 = W_0 C^{rt}$ where W_1 is the weight at the time t; W_0 is the initial weight; $C = 2.718$; r is the factor of intensity (representing the relative growth rate) and t is the time. This formula is only applicable during the season of most rapid growth and was devised by making experiments on plants.

PUTTER (1917-1920) starts from the principle that actual growth is the difference between the building up and the breaking down of the organic substances in a living organism. When this difference reaches 0, the end of growth is also reached. The amount of living substance formed in the time unit, is according to PUTTER proportional to the square of the linear dimension viz, to t_1, and the amount of living substance decomposed in the unit of time if a given fraction of the total quantity of the organic matter of a body. The growth limit depends on the following conditions $\frac{L = K}{K_1}$, where k is the maximum value of possible growth, K is the rapidity of the decomposition of the organic matter (and hence a constant that cannot be separated) and k is the formation of new construction material produced by the interchange of substances (which depends upon the organism itself). L and λ are not measured empirically, but are deduced from $\sqrt[3]{G}$ where G is the weight.

ROBERTSON (1908) started from the idea that growth chiefly depends on the ultimate size of the individual ($= A$). In order to plot the growth curve, he made this not only proportional to the quality of the growing substance ($= x$), but also to the difference $A - x$. ROBERTSON obtained the following equation by taking into account the similarity already noted by LOEB between autocatalytic reactions and growth processes $\frac{x}{A - x} = H\ (t - t_1)$, where k is the growth constant, t is the time under consideration and t_1 the time in which growth produces the size $\frac{A}{2}$. ROBERTSON tested his formula with positive results and used it in the case of man, white mice and frogs. The author tested the formula by applying it to 65 calves and obtained concordant figures for the found and calculated weights, from birth to the sixth month.

M. OSTWALD (1908) used the following equation $f = \frac{dx}{dt}$ to express the increase in weight of growing animals. x is the property to be estimated, t the time, and f a function of the growth. The growth curve, as he found, takes a similar course in the case of the most different organisms whether plant or animal and also in that of a single cell.

RUBNERS' formula based on the constancy of energy is of much more general application than the formulae we have just considered. The amount of energy (measured by calories) employed in doubling the weight of an animal is the same in the case of all organisms whatever may be the rate of development. When any animal has reached its final size, the substance of its cells has put forth an equal amount of energy in the work of growth. This "dynamic

law of growth " is expressed by RUBNER'S formula, $U + W$ = constant, where U is the calories developed in the decomposition of food during the growth period and W is the growth. Therefore W equals the product of the daily number of calories used (e) and of the period (in days) of growth ; hence, $e \times Z + W$ = constant.

It follows from this law of growth energy, that the amount of energy used in growth is independent of the rapidity of growth. On the other hand, the formation of new living matter requires the same fraction of the total amount of metabolic energy in growing animals, that is to say the growth quotient is always the same.

Taking as his basis the great importance of the law of surface areas for all the processes of energy, RUBNER first (1902) formulated the relation existing between mass, employment of energy, and surface area. The growth of mammals that are developing is always the same relatively to the surface area and generally the output of energy required to attain this growth rises from 100 to 159. The average composition of the body and its nitrogen content do not alter during growth ; therefore for a 100 % increase in the amount of nitrogen, there is a 59 % increase in heat production ; viz., a 1 % increase in nitrogen means a 0.59 % increase in heat production, *vice-versa* a 1 % decrease in nitrogen causes a 0.74 % decrease of energy in calories.

The author concludes by giving a list of questions that can only be answered by means of experimental investigation.

566. *Grafting interstitial glands on horses.* — Dr VECCHIA, Director of the Royal Stud Station of Reggio Emilia, has performed this operation on a valuable horse suffering from premature senility. The interstitial glands used were taken from another horse of the same Station. The operation was most successful and perfectly effectual, the reproductive energy of the stallion was restored and its general condition of nutrition and activity remained normal. (*L'Italia vinicola ed agraria*, Year XIV, No. 8, p. 125, Casal Monferrato, 1924).

567. *Food valves and body needs.* — The object of the Bulletin is to enable the student of foods to see quickly in what proportions the five important constituents — energy, protein, calcium, phosphorus and iron — are supplied in 50 common foods. The charts show at a glance how much of the different foods are required to make a complete ration, or what food can best supply any particular constituent. (*Farmers' Bulletin*, No. 1383, pp. 35, charts 50, U. S. Department of Agriculture, Washington, D. C. 1923).

568. *Handbook on better livestock feeding.* — This booklet contains in condensed form practical and up-to-date information on the feeding of cattle, hogs, sheep, horses, and poultry, compiled as a result of a wide study of farm feeding problems.

In this handbook all the different classes of animals are considered separately. For instance, there is special information on feeding young animals, dry cows, sires in service, weaning pigs and calves. Consideration is given to the feeding of farm wastes and by-products, the use of mineral feeds, the use of self-feeders, tonics, hogging down crops, commercial feeds, dehorning and castrating, with relation to feeding and management, mixing feeds and making up balanced rations, shelter for animals as it affects their production, water

and salt. Sample rations are given for the various kinds of animals under different conditions. The importance of good breeding in obtaining maximum gains is emphasized.

"No set of specific feeding rules can be wisely applied throughout the country" says John R. MOHLER, Chief of the Bureau of Animal Industry, in a foreword to the handbook. "Local conditions, seasonal changes, and many other factors", he continues, "combine to make the best feeding practices change from place to place and from time to time. This handbook discusses the main points most commonly encountered in feeding, but which should always be adapted to local conditions. More general discussions of feeding practices will be found in *Farmers' Bulletin* and other publications of the department, also in publications of the State agricultural colleges and experiment stations.

Copies of the handbook, which is known as Miscellaneous Circular 12, may be obtained free, as long as the supply lasts, by addressing the Department of Agriculture, Washington, D. C., U. S. A.

569. *Estimating the weight of cattle on the basis of the circumference of the chest.* — The following method was proposed by Erich SCHULZ von VORSKOWSKI and is recommended by Prof. B. MORESCHI on account of its extreme simplicity. The circumference of the chest if measured behind the withers and expressed in centimetres runs into three figures, the first is disregarded, the second denotes a zentner (100 pounds) and the third a pfund (0.5 kg). To the sum of these two weights is added, for a circumference exceeding 150 cm., a number of pfunds that increases with the circumference (on account of the parallel increase in the weight of the skeleton) in the following manner: from 150 to 155 cm. 20 pfund; from 156 to 160 cm. 30 pfund; from 161 to 165 cm. 40 pfund; from 166 to 170 cm. 50 pfund; from 171 to 175 cm. 60 pfund; from 176 to 180 cm., 80 pfund; from 181 to 185, 100 pfund; from 186 to 190 cm. 120 pfund; from 191 to 195 cm. 140 pfund; from 196 to 200 cm., 160 pfund; from 201 to 205 cm., 200 pfund; from 206 to 210 cm.; 250 pfund; from 211 to 215 cm., 330 pfund; from 216 to 220 cm., 430 pfund; from 221 to 225 cm., 450 pfund; from 226 to 230 cm., 450 pfund and for circumferences exceeding 231 cm., 500 pfund (the growth of the skeleton having ceased) (B. MORESCHI, *Giornale di Agricoltura della Domenica*, Year XXIV, No. 7, p. 60, Piacenza, 1924).

570. *Functional genotypic selection of Holstein-Friesians in the United States.* — The Society of Breeders of Holstein Friesian Cattle in the United States which since 1885 has organised milk control of the dairy cows entered in its Pedigree Book has recognised for some time past that, in order to effect more rapid and certain improvement, it is not sufficient to eliminate the least productive cows (mass, or phenotypic selection). It is also necessary to identify and select the families and lines (pure lines if possible) with high milk yield and high butter-fat percentage (genotypic selection). The society has therefore started an Advanced Register in which are entered the most productive cows and the bulls that have sired the cows giving most milk and butter. This genotypic system of selection has given satisfactory results.

An exceptional specimen of cow on the Advanced Register is Duchess

Skylark Ormsby which gave in the year 12 589 kg. of milk containing 543 kg. of butter-fat. (*Rivista di Zootechnie*, No. 1, 1984, Portici).

571. *The Piedmontese Breed of Cattle* is regarded by Prof. A. GIODA, Direttore del Comizio Agrario di Mondovì, as one of the best milk-yield breeds of Italy and well able to bear comparison with the Brown Swiss breed, provided it is carefully selected; he therefore expresses the wish that this selection work should be carried out at the new Stock-Breeding Station at Cuneo.

At the Dairy Cow Show organised by the " Comizio Agrario di Mondovì " the following plan was adopted : the best milkers were chosen from their external appearance and then subjected to milk control for a whole year, the milking register being of a, very simple type. The cow to which-the prize was awarded was six years old had calved in November 1920, and yielded on an average 14 kg. of milk daily in May (the sixth month after calving) ; 13 kg. in June ; 12 in July ; 7 in August ; 6 in September , 5 in October ; 4 in November, that is to say 1860 kg. in the seven months of the test and not less than 3500 litres in the twelve months of continuous lactation.

572. *Selection and crossing in poultry-breeding.* (From a series of reports in the *National Poultry Journal*, Nos. 121, 123, 126, 132, 133, 134, vol. III, London). — P. L. STANLEY gives the outstanding results obtained with a White Leghorn cockerel (bred from a 12 months trap-nested brid with 265 egg record) and well selected White Wyandotles, Briff Orpington and White Orpington. All the Wyandotte cross possessed large Wyandote combs and dusky white feathers, dark legs with white on the shanks (although both parents had yellow legs). The cockerels and pullets from the White Orpington cross were 75 % white plumage and the remainder blue ; legs clean white. Of the Buff cross none came pure as regards plumage ; good white legs.

O. SMART discusses " Poultry Farming and research work ", and notes the importance of sex distinction of chickens at birth. The results of his own tests have led to the conclusion :

1. White Leghorns × Indian Game cockerel (yellow legged) : chickens with yellow legs male, those with dark legs female. The pullets are, however, bad layers.

2. Silver hens × Gold cocks give females always gold and males always silver.

Pencilled Wyandotte = Golden Pencilled Wyandotte give fine table birds at 14 weeks of age ; pullets moderate layers.

3. Black legged cock × White or yellow legged hens e. g., White Leghorn × White La Bresse give females with blue or black legs and the majority of males yellow legs ; an excellent table cross and good layers.

The programme of the work undertaken by the Animal Breeding Research Department Edinburgh includes :

1. *Systematic study of linked inheritance in the domestic fowl with special reference to breed and utility characteristic.* — The study of crossing and back-crossing is proposed for the following breeds : Minorca, Light Brahma, Rose-comb White Dorking, Houdan, Black Scotch Dumpie, Black Leghorn, Brown Leghorn, Partridge Wyandotte, Golden Campine, Salmon Faverolles, Gold-pencilled Hamburgh, Sicilian Butter crop.

2. *Nature of hybrid vigour in the domestic fowl.* — Rhode Island Red × Light

Sussex cross is under investigation and a study will be made of hereditary factors including fecundity, maturity, shape and size.

3. *Physiology of the sexual cycle in the domestic fowl.* — Investigations will include: *a*) microscopic study of correlative changes in the pituitary, thyroid, adrenal glands and internal organs of reproduction in relation to the out-standing phases in the sexual history of the bird; *b*) effects of administration of glandular preparations upon sexual maturity and broodiness.

4. *Determination of sex in the domestic fowl.*

5. *Factors influencing success in natural and artificial incubation.*

N. Brooksbank, poultry raiser, applying the results obtained by Punnett at Cambridge has successfully crossed Light Sussex with "Brown Leghorn", and has confirmed the results obtained with "White La Bresse" and "White Wyandotte".

J. Dryden of Oregon Agricultural College Corvallis, has succeeded with "Barred Plymouth Rocks" to increase the production by breeding and to nearly double the egg production in less than 10 years (average about 86 eggs in the first year and White Leghorus (average 106). By crossing these breeds and breeding back to Leghorns for two generations and then mating, the same result was secured. The first crosses gave a low production, though higher than the Leghorns or Rocks. Further crosses gave for F_1 135.5 eggs per hen. In six generations this was increased to 231.5.

The simplicity of increasing production by breeding is emphasised. One of the chief factors of importance is moisture conditions in connection with incubation.

Observations are made as to: 1) fat content in eggs in relation to rate of laying; 2) intensity of laying in the first year as indication of high standard in succeeding years; 3) hens which have inherited good laying capacity come to laying maturity sooner than the pullet of poor laying capacity; 4) there is no particular correlation between the various measurements of hens; both good or bad layers may have long or short backs; a long or short keel, etc.

Noland has shown by experiment that the idea that eggs from unselected food laying hens do not always "perform" is unfounded. In one year starting from November, when the hatching took place, the hens selected and the discarded hens produced almost an equal quantity of eggs and the slight inferiority of the eggs from the latter group was compensated for by the fact that the maximum quantity was produced in winter and therefore of good market value. The egg laying capacity depends on several factors and not on one only.

573. *The Catalana, or Prat poultry race in Italy.* — The Catalan race was created in Spain by crossing Asiatic races with local races. The hybrids produce much delicate flesh and also lay many and large eggs. According to the biometrical studies carried out at the Rovigo Avicultural Station, the average weight of the cocks is 3 kg., while that of the hens is 2.1 kg.; the eggs weigh on an average 63.9 gm. The breed is very hardy and quiet, so that the fowls do not need much space, but they should be provided with shelter from the weather and frost. The Catalana race is much to be recommended for the hot districts of Italy.

The Rovigo Station possesses very fine specimens of these fowls that are

descended from stock purchased at the World Poultry show at the Hague. The cocks are very suitable for mating with the various local races. The Director of the Station, Prof. A. GHIGI has tried crossing the Catalan race with the native Polesan race and has obtained specimens of two types, in one the birds are fine and uniform, and of a partridge colour. The eggs of the hybrids are far larger than those of the common fowl; they weigh on an average 68 gm., although some turn the scale at 74 gm. After the hens have laid for some time, the weight of the eggs decreases although it never falls below 60 gm. The Catalana fowl requires plenty of food, otherwise its good points do not come out. (*Giornale di Agricoltura della Domenica*, No. 12, 1924).

574. *Fowls and fowl-house construction.* — P. PITANCE, describes how fowls should be lodged in order to make them as confortable as possible, and he discusses the four factors : air, light, comfort and hygiene in regard to their bearings on fowl-house construction. One chapter is devoted to shelters and pens. The author concludes by giving exact details of the construction of a fowl-house that can be built by the poultry-keeper himself.

The first pamphlet deals with the different breeds of poultry (" Race de Poules "). The pamphlet reviewed above is followed by others entitled : Laying (" *La Ponte* ") How to make an Incubator (*Comment construire sur même une eleveuse artificielle*). Chicken-rearing. How to feed fowls — Treatment of Fowl Diseases (*Comment soigner les poules*«). — A House for 2000 Laying Hens (*Une installation pour* 2000 *pondeuses*).

" Comment loger les poules, comment construire soi-même un poulailler (in 16°, pp. 16, figs. 9, Libraire speciale agricole, 58 Rue Claude Bernard, Paris V), part of a series entitled : " connaissances pratiques sur l'élevage de la poule ".

575. *Polyembryony in silk-worms.* — This term is applied to the hatching out of 2 larvae from a single egg (Bione, Medio Varo, Chinese Tau Kwei, White Chinese breeds) or of 3 larvae from one egg (Green Chinese). The phenomena have been observed by L. PIGORINI and R. DI TOCCO during their studies at the R. Stazione bacologica di Padova ". (*Atti della R. Accademia dei Lincei*, Vol. XXXII, Parts 3-4, pp. 102-105, Rome, 1923).

576. *The effect of electrical high frequency fields on embryonic development* has been studied by L. GIANFERRARI and E. PAGNOVANONI in the " Museo Civico di Storia Naturale di Milano " on fertilised eggs of *Salmo lacustris*. Many and varied monotrosities were produced in the majority of cases malformations consisted in the re-duplication of the anterior parts. (*Atti della R. Accademia dei Lincei*, Vol. XXVII, Vol. II, pp. 576-578, Rome, 1923).

577. *Neolithic material used in the preparation of soil.* See : *Comptes rendus de l'Académie des Sciences de Paris*, No. 4, Bol. 176.

578. *New method of detecting the adulteration of coco butter.* — The number of cc. of acetyl-acetic ether are found which it is necessary to add to a 20 % solution of chloroform in order to render it persistently turbid at ordinary temperatures. By means of liquefaction it is also possible to separate coco-butter from the other vegetable butters used for its adulteration. (A. ROZHLER, *Comptes Rendus de l'Académie des Sciences*, Paris, Session of March 10, 1924).

579. *Separation by the acetone method of the proteids of milk serum.* — This method was devised by PIETTRE and A. VILA for the analytic treatment of

blood serum or plasm. PIETTRE found that by the acetone method, milk serum, like blood serum and white of egg, could be decomposed and the proteids separated out. This treatment did not destroy any of the elements of the milk. Milk albumin is characterised by the physical properties of its solutions and its peculiar appearance when solid. If forms a syrupy light-coloured substance which when cold suddenly becomes a solid white mass, that again becomes soft under the heat of the hand. (*Comptes Rendus de l'Académie des Sciences*, Paris, Vol. 178, No. 3, 1924. *Ibidem*, Vol. 170, p. 1466, 1920).

580. *Improvements to be introduced in the manufacture of a "Pasta Cotta" cheese.* — The manufacture of these cheeses can be greatly simplified and many accidents can be avoided by using liquid rennet and inoculating the milk (which should be collected with care to insure cleanliness) with a lactic ferment prepared at the temperature of 45-50° C. from skimmed boiled milk, preferably with serum pastorised at 100° C. (P. MAZE, *Comptes Rendus de l'Académie des Sciences*, Paris, Vol. 18. (No. 12, 1924).

581. *The antiseptic power of bi-chromate of potassium and of bi-chromate of copper* has been studied by A. SARTORY and R. SARTORY. The authors recall the CHAVASTELON process (1) for preserving timber with bi-chromate of copper which led them to study the antiseptic action of this salt in destroying cultures of fungi (*Penicillium glaucum*, *Mucor racemosus*, *Rhizopus niger*, *Phycomyces splendens* and *Sterigmatocystis nigra*). They arrived at the following conclusions: 1) bichromate of copper has a stronger toxic action on the inferior fungi studied than bi-chromate of potassium; 2) the structural changes observed in the cultures in the presence of bi-chromate of copper are more far-reaching than those observed in the case of bi-chromate of potassium. (*Comptes-Rendus de l'Académie des Sciences*, Paris, Vol. 178, No. 15, 1924).

582. *Three new insecticides*, two of them chemical and one mechanical, have been developed by the joint forces of the experts on insect fighting of the U. S. Department of Agriculture, of several States, and of the National Canners Association. They are calcium cyanide, nicotine dust and the "aphidozer". Calcium cyanide is made from lime and the nitrogen of the air and can be produced cheaply. Both of the chemicals have been successful against the common pea-louse or aphid, against which the National Canners Association is waging a determined fight. This insect has given its name to the aphidozer, the mechanical insecticide. This machine when driven through a field of pea vines sweeps off the aphids into a container, as much as eleven pounds of the plant lice have been collected from 2.5 acres of peas. (*Science*, Vol. LXI, No. 1523, p. XIV, New York, 19241).

(1) See *R.*, 1924, No. 301. (*Ed.*)

ALFREDO RUGGERI, *gerente responsabile*.

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NOTE. — The Bureau assumes no responsibility with regard to the opinions and the results of experiments outlined in this *Review*.

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ORIGINAL ARTICLES

THE IMPROVEMENT OF RACES OF AGRICULTURAL PLANTS AND LIVE-STOCK AND MODERN GENETICS.

Modern studies of the improvement of races of agricultural plants and live-stock are based upon the recent discoveries of biological science and especially upon four classes of facts, experiments and theories which for the sake of clearness may be grouped under the following heads :

(1) The hereditary phenomena of crossing and the theories relating thereto ;

(2) The conception of mutations, or sudden variations ;

(3) The conception and definition of elementary species as compared with the Linnean species ;

(4) The cytological theories connected with the study of hybridisation and of mutations.

Ever since man has reared domestic animals and cultivated vegetables and cereals by the light of every-day experience, as MASSART expresses it, he has been aware of the fact that the offspring resembles the parents. Further, not only the characters proper to each species are transmitted, but even apparently insignificant details.

The scientific study of hybrids, or the progeny resulting from the union of two individuals differing from one another in a certain number of characters, has revealed many facts of undoubted interest which allow different classes of phenomena to be grouped together.

When the hybrid is intermediate in character between its two parents, it is termed an intermediate hybrid.

In other and rarer cases, the hybrid is unilateral and only reproduces the paternal characters (patroclinic), or the maternal characters

(matroclinic), as happens in some strawberries and in certain animals (amphibians) resulting from experimental crossing.

Finally, alternate or Mendelian inheritance properly so-called is encountered. In alternate inheritance, one of the parental forms is dominant in the first generation, whereas in the second generation segregation takes place, the hybrids resembling one or other of the parents, there being no intermediate forms (Mendelian inheritance of the pea-type).

Millardet in his article on hybridisation without crossing or false hybridisation of certain species of the genus *Fragaria* has attempted to prove that the products obtained form an exception to the general rule of mixed inheritance in so far that they exactly reproduce the specific type of either the male or the female parent (unilateral hybrids). Owing chiefly to the influence of Giard, these unilateral hybrids have been explained as cases of parthenogenesis, male or female, inasmuch as in the first case, the male element is believed only to stimulate the development of the ovum, and in the second (as zoologists have found to occur in ephebogenesis), the male cell develops at the expense of the ovum, which only supplies the nutritive and not the hereditary substance so that the inheritance is wholly patroclinic.

Matroclinic inheritance, which is relatively frequent in some genera of plants, appears also to be explained by parthenogenesis or pseudogamy, the latter term being used by Focke to express the absence of fusion between the male and the female cell.

Intermediate hybrids include mosaic hybrids and mixed hybrids. In the former, the parental characters are distributed in mosaic fashion in the various parts of the body, while in the latter, they are mixed and superimposed, but recent researches have shown the existence of all the intermediate forms between mixed and mosaic bastards. Intermediate hybrids (taking the term in a wide sense), are intermediate in form between the pair of opposite characters. The type of inheritance known as the "maize type" or the Zea type is also very common among plants. If for instance, a line of *Mirabilis Jalapa* with red blossoms is crossed with a white flowered line, the hybrids of the first generation (F_1) bear red flowers.

Ribes intermedium is the result of crossing *Ribes nigrum* with *Ribes sanguineum*. Amongst animals, the hybrids ("leporids") between the hare and the rabbit are a classical instance as is also the mulatto resulting from the union of a negress and a white man.

or *vice versa*. The variety of *Zea Mays* with blue grain, if fertilised by a variety of maize bearing yellow grain, produces a hybrid with violet grain, while if a black and a white fowl of the Andalusian strain are mated, pure blue Andalusian chicks are obtained.

On the other hand, in that form of intermediate hybridisation in which there is mosaic segregation, the parental characters do not fuse or separate but appear side by side in the form of a mosaic in each hybrid individual. Thus, the hybrids of *Linaria vulgaris* (with yellow flowers) and of *Linaria purpurea* (with purple flowers) have variegated yellow and purple blossoms.

Mosaic inheritance has been called by BLARINGHEM Naudinian inheritance after the botanist NAUDIN who discovered the law governing it (1).

Modern science has sought to find for MENDEL's laws of alternative inheritance a cytological basis which MENDEL himself believed to exist. BATESON says " by crossing two species of opposite characters, hybrids are obtained ". It has been shown that the reproductive characters of these species are of two kinds, each of which is pure in regard to one alone of the hereditary characters. This property of the germ cells and their consequent incapacity of transmitting both of the opposite characters is the principal fact that has been demonstrated by the work of MENDEL.

It is not however surprising that when MENDEL's laws were rediscovered, an attempt was made to make them agree with those theories of inheritance which, like that of WEISMANN, tried to locate in the germ cell the hereditary particles representing the different characters and to explain the separation of the unit characters by means of the mechanism of the reducing division that accompanies the maturation of the sexual cells.

(1) Another special class of hybrids is that of the graft hybrid, well-known among plants, which is important both from the agricultural and the genetic standpoints. LO PRIORE's view may be adopted and graft hybrids regarded as the result of the somatic cells of the stock and the scion which are capable of producing individuals with intermediate characters or upon which has been superimposed a mosaic of elements of variable size and different modes of arrangement.

The analogy existing between graft hybrids and sexual hybrids might give rise to the idea that the first are the products of the union between two vegetative cells, one belonging to the stock and the other to the scion, but this hypothesis which was suggested in 1850 by Alessandro BRAUN is at variance with WEISMANN's theory of Chromosome reduction. According to STRASBURGER, a graft-hybrid would appear to be a hyperchimaera, viz., a special graft with vegetative apices possessing two kinds of embryonic cells.

According to various authors, MENDEL's law of alternate inheritance may be summarised under the following heads:

(1) *The principle of unit characters*: The inheritance of an organism may be regarded as composed of a series of characters that are transmitted in the form of indivisible units, or character units (DE VRIES).

2) *The principle of dominance*: The opposite unit characters present in the parents do not generally mix in the offspring, but one of them is dominant and usually succeeds in expressing itself completely, while the other is recessive and is temporarily concealed.

(3) *The principle of segregation*: Each sexual cell is pure as regards some unit character, even if it is derived from an impure, or hybrid parent. In hybrids, the determinants of opposite characters are separated in the sexual cells in such a manner that the latter are different and pure as regards a determined unit character (CONKLIN). The principle of segregation was indirectly included in SANSON and QUATREFAGES' law of reversion which is well-known to stock-breeders, but the advance in MENDEL'S views consists in the substitution for the theoretic concept of atavism the concept of the segregation of unit characters in the sexual cells.

The principle of dominance had also been already advanced by GODRON (1859), but MENDEL defined its scope by means of his hypothesis of unit characters.

In the modern parlance of Mendelian inheritance, the word "factor" is used to denote something that undergoes segregation in the sexual cells and is in some way or other connected with the organism containing it upon which it exercises a certain influence (MORGAN).

In the nucleus, the inherited particles (genes), which are localised in the chromosomes, would seem to correspond to the factors. The chromosomes, as is well-known, occur in a fixed number in each species, and if n is the number of chromosomes of the species, the sexual cells when mature contain n chromosomes, so that by fertilisation, the original number n is made up. It will be seen presently how Neo-Mendelism has tried to bring the known cytological facts into agreement with the present laws of heredity.

Every germ-cell (gamete) possesses a transmissible unit (gene) for each character.

If in the zygote, or product of the union of two sexual cells,

there are two genes representing the same character, a homozygote results.

BATESON calls every 2 *x* product a zygote and reserves the term homozygote for the cell derived from the union of two similar gametes (*A A*), and that of heterozygote for the product of the union of two dissimilar gametes (*A B*).

The heterozygote is characterised by the fact that in the formation of the germ-cells, the opposite particles do not pass into the same cell, but always divide. If the female heterozygote *A B* produces eggs, these eggs contain either *A* or *B*, this being the law of the scission of heterozygotes. From the cytological standpoint, this would seem to be explained by the fact that the genes representing the opposite character are situated, in the homologous chromosomes (respectively of paternal or maternal origin) of the 2 *x* generation which during the formation of the mature sexual cells, resulting from a process of reduction, divide once more.

Two factors united in one heterozygote are called " paarling ". a pair (CORRENS) or concurrent factors (TSCHERMAK), or antagonists, or allelomorphs (BATESON).

When only a single genotypic difference exists between the parent organisms *P*, the F_1 hybrids have two kinds of gametes, and therefore in the F_2 hybrids, there are four combinations. In such a case, we have, for instance, *V V*, *V v*, *v V* and *v v* and since *V v* and *v V* are the same, there are three genotypic constitutions. Since however, when dominance is present, *V v* and *V V* individuals are apparently or phenotypically identical, the number of different phenotypes is only two.

On the other hand, with two genotypical difference like *A*-*a* and *B*-*b*, we have four kinds of gametes (*A B* ; *A b* ; *a B* ; *a b*) and hence $4 \times 4 = 16$ combinations.

In doubled heterozygosis, the formula for the distribution of the phenotypes is $(3 + 1)^2 = 9 : 3 : 3 : 1$.

The higher the degree of heterozygosis, the smaller is naturally the number of homozygotes as compared with that of the heterozygotes.

According to the " presence-absence " theory, the dominant character alone is represented by a material body, whereas the recessive is due to the absence of this body. The red and the white colour of sweet-peas would, for instance, form such a pair ; white being only due to the absence of red. Thus can probably be explained the fact

that in many plants and in many animals colour is dominant over absence of pigment.

PLATE, however contends that the recessive character also has a material basis, or "fundamental factor", and that by means of adding a "supplement" the dominant character is obtained.

In the classical and typical case of Mendelian inheritance, the varieties differ in one character only, and if *A* is crossed with *B*, the resulting *A B* form produces pure gametes, *A B*. These are what BATESON terms simple allelomorphs. If on the other hand, it is a question of a complex character, the allelomorphs are complex and in the formation of the gametes they divide into hyp-allelomorphs, in which case the zygotes do not form gametes of two kinds, but a number of different gametes, and in the subsequent generations, the different characters appear combined according to the rules for the crosses of hybrids and polyhybrids.

From the union of different kinds of gametes there arise different forms known as varieties. Those varieties that originate from the separation of pre-existing complex characters are called by BATESON "analytic varieties" in contradistinction to "synthetic varieties" which are not due to division, but to the addition of a new character.

According to the "presence-absence" theory, the recessive gamete *R* does not contain any gene, but according to the "impurity of the gametes" hypothesis it contains part of the dominant gene *D*. It may also be supposed that the factors do not divide into two parts, but *D* is found in the latent condition *R* (*D*) and in this manner the impurity of the gametes would be due to a latent state.

The advocates of Mendelism have long contended that the purity of gametes means that the hybrid *D R* forms germ-cells containing only *R*, or only *D*, but since the *R* individuals on being fertilised sometimes reveal the dominant character *D*, the theory of the "impurity of gametes" has arisen together with the kindred hypotheses of contamination or "changes of value".

Those processes which are not included in splitting may be called with PLATE "changes of value".

According to PLATE's theory, the recessive state depends upon one gene, or fundamental factor, which he regards as a chromosome. The supplement, on the other hand would seem to be an enzyme which by its action on the fundamental factor produces the dominant quality. Since every enzyme has a specific action, there must be an enzyme for every gene. If an enzyme becomes inactive, the de-

minant character is changed into the recessive which may explain the phenomena of the inversion of dominance met with in some breeds of animals as the individuals become older.

JOHANNSEN maintains that the idea of a factor is chemical rather than morphological and BATESON attributes to these particles properties similar to those of ferments.

It must be allowed that the morphological and the chemical theories of genes appear in opposition from a certain point of view. An attempt has been made to account for certain contradictions to the laws of MENDEL by bringing forward a number of subsidiary hypotheses, which however only have the effect of shaking the foundations of the theory itself.

External characters may depend upon one, two, three or more genes of different hereditary quality and can be distinguished as monogenic, digenic, trigenic and polygenic. This has given rise to different inheritance formulae (CUÉNOT). In opposition to the polygenic quality there are various equalising factors (NILSSON-EHLE) viz., several factors that act together to produce the same external character such as the same colour, or a given length of an organ, such being intensifying or cumulative factors.

LANG gives the names of " polymerism " and " genomerism " to this phenomenon and these factors respectively, while TSCHERMAK speaks of plurifactorial differences and PLATE uses the term " homomerism ". On the other hand, in characters that are not " equalitarian ", but polygenic, the different factors can in their turn influence the characters and may be either epistatic or hypostatic (BATESON). The term epistatic has been introduced by BATESON and signifies the cloaking (*Verdeckung*) of a dominant factor.

The character that masks is called epistatic, while the masked character is described as hypostatic. A character may in this way become invisible or latent although it is present all the time, which is entirely different from the cases of typical Mendelian segregation of two simple opposing factors. In these cases of hypostasis, the segregation factors are naturally complicated (BAUR).

For instance, in the inheritance formula *S. G. D* of grey in which *S* represents a black pigment, *D* its intensity and *G* a yellow pigment, the latter may be wholly masked by *S* so that its presence can remain unsuspected until it is revealed by crossing. In this manner, it behaves like a cryptomeric character (TSCHERMAK), that is transmitted without its existence being known. TSCHERMAK gives the name

of cryptomerism to the phenomenon of the appearance of new and often atavistic characters that were apparently absent in the parents.

In other words, a character may dominate another without being its allelomorph. According to BATESON, there are positive characters which behave to one another as if the one were dominant and the other recessive.

Thus the dominants of different pairs may be interrelated as epistatic and hypostatic factors, but whereas the dominant and the recessive factors of the same pair divide and migrate to two different sexual cells, the epistatic and hypostatic genes can pass without separating into the same germ-cell.

As JOHANNESEN rightly says, epistasis has nothing to do with dominance in the strict Mendelian sense of the term.

Colour, in many cases, is a polygenic character. BATESON and PUNNET have studied it in the sweet pea, on which among the various different factors, there is one which acts as the developing and another that plays the part of an intensifying factor. This would explain the fact that on crossing two varieties of sweet peas, both with white flowers, a hybrid with purplish red flowers like the wild Sicilian type is obtained.

BAUR states that in *Antirrhinum*, the colour and shape of the flowers depend upon as many as twenty factors, while CASTLE believes the coat colour of rabbits to be determined by eight factors of which one for instance decides the intensity and the other the uniformity of the colour.

The independence of the colour is not however always evident ; thus in the flowers of *Lathyrus odoratus*, a certain shape is correlated with a given colour. BATESON suggests that this may be due to the existence of complex relations between the unit of inheritance which cause some combinations to occur more often than others.

In analysing the characters of a race, it must not be forgotten that the same hereditary factor may give rise to different external characters which make their appearance at the same time, or pleiotropism according to PLATE. The phenomenon of pleiotropism has therefore to do with the correlation of organs to which attention had already been called by DARWIN in his memorable works.

When a gene is pleiotropic in its action, or manifests itself in different places, it is a question, according to FRUWIRTH, of a correlation of the quality ; when however one gene is present for each quality, there is a correlation of genes.

As TODARO rightly states, the study of correlations is a matter of the greatest theoretical and practical interest. Seemingly insignificant characters and organs have often guided the selector to his greatest triumphs, while the success of breeders depends chiefly upon their capacity to realise more or less easily and rapidly the correlations that may exist in the plants on which they are working.

Important in this respect are NILSSON'S researches on the correlation of characters in varieties of fine-grained barley suitable for brewing; his work proves the importance of correlation between botanical characters and agricultural properties.

In the segregation of unit-characters, it is found that sometimes certain characters, instead of being absolutely independent, are bound together in such a manner as always to be transmitted together, but never separately. Linkage is the term for this associated hereditary transmission of characters. In order to find a material basis for this phenomenon of linkage, Mendelians suppose these characters to be present in the same chromosome, so that when a chromosome passes in its entirety from the mother-cell to the daughter-cell, all the characters whose determinants are situated in the same chromosome invariably remain linked together.

In the case of two linked characters, it should be noted, that in gamete-formation, instead of gametes of 4 kinds, as in a typical Mendelian hybrid, there are only 2 kinds, and the hybrids will be composed of three forms like a monohybrid.

Drosophila having 4 chromosomes of unequal length is a particularly favourable subject for determining which chromosome contains any special determinant, since the largest number of interlinked determinants are referred to the longest chromosomes and the smallest to the shortest chromosomes.

An attempt has been made to define the cytological basis of the Mendelian laws by supposing that the hereditary outlines of the whole organism occur in duplicate in the immature germ-cell (2 x generation), one group being of maternal origin and the other of paternal origin.

Subsequently, the sum of these hereditary outlines are thought to be arranged in such a manner, that two homologous chromosomes (viz. one of paternal origin and the corresponding chromosome of maternal origin) will contain the same number of determinants (or genes) with the result that the determinants of every character will be duplicated in the fertilised sexual cell.

An organism containing $2n$ chromosomes (diploid number), would therefore possess two homologous (paternal and maternal) series of hereditary outlines that again divide in the immature germ-cell into n chromosomes (haploid number).

Supposing the factors to be arranged in a line along their respective chromosome and admitting the individuality of the chromosomes, then when two organisms differ by as many characters as there are chromosomes, the normal process of nuclear division accounts for the distribution of the characters in the hybrids, but when on the other hand, the organisms differ by a larger number of characters than there are chromosomes, an interchange of particles can, in MORGAN'S opinion, always be understood.

In order to get over the difficulty of this apparent contradiction of the laws of disjunction, recourse is had, where the identity of the chromosomes is admitted, to the theory of so-called " crossing-over ", according to which the two homologous chromosomes twist over one another and uniting at the point of contact appear to change places with the homologous chromosome, so that there is an exchange of allelomorphic factors. Finally, in cases of polymerism, or of multiple factors producing an external quality, it is conceded that these factors are localised in different chromosomes and not in homologous chromosomes as is the case with opposing characters. The theory of multiple factors thus serves to explain certain deviations from the Mendelian laws, but the numerical ratios, in simple Mendelian cases, can also be disturbed by the fact that in the production of the gametes in the F_1, on account of a special attraction exerted amongst some factors during the process of division, the various gametes are produced in proportions differing from the normal ratio, so that in the case of a di-hybrid $A\,a\,B\,b$, by means of a special attraction (coupling, or " Verkoppelung "), between A and B, and between a and b, the four gametes $A\,B$, $A\,b$, $a\,B$, $a\,b$, are not formed in equal numbers, and therefore the distribution formula of the phenotypes varies from that of the typical duplex heterozygous condition.

An opposite phenomenon is repulsion which prevents the production of some gametes, or causes them to be present in smaller proportions than the ratio forecasted according to simple Mendelian phenomena. In short, neo-Mendelism has endeavoured, wherever possible, to reconcile cytological data with the phenomena of inheritance in crosses either by means of reference to the mechanism of reduction division, or by stating like BATESON that segregation takes

place prior to reduction which suggests the old idea of pre-reductional somatic segregation.

The neo-Mendelians regard segregation as an essential fact, while the phenomenon of stable intermediate forms is explained by the theory of multiple factors. If the products of the first generation (F_1) are intermediate, those of the F_2 will present more marked differences. A large number of similar factors would seem to depend on segregation (hypothesis of homoeomerism). LANG practically denies the existence of alternate inheritance which would explain the characters of intermediate hybrids such as varieties of shade in mulattos. In fact, according to the hypothesis of LANG and EAST, certain characters as being the result of the cumulative effect of similar factors would be more or less dominant according to the number of cooperating factors in each special case (CONKLIN's mixed inheritance).

Finally, there are some biologists, like the botanist BAUR, who on the other hand, question the fixity of intermediate hybrids, even in the crossing of species.

The intermediate hybrids of species of the genus *Hieracium*, which are a stock instance, have been explained in quite another way by BAUR. Such hybrids come from parthenogenetic diploid eggs, and since reduction division takes place without segregation in such cases, the hybrids would be of an intermediate character.

In the opinion of the neo-Mendelians, dominance and recessivity have only a secondary importance and both BATESON and MORGAN agree with this view. In the case of intermediate hybrids it is, according to MORGAN, quite impossible to know which of the two characters is dominant.

According both to BATESON's and MORGAN's theories which admit the principle of indivisible factors, separation is a necessary process in inheritance.

It is certain that one way of analysing the laws governing hybridism would be to study cases where the two races crossed do not differ in possessing a pair of opposing characters (bisexual crossing), but differ, as happens in two different species, in one given character (unisexual crossing) that would remain solitary in the cross.

In unisexual crosses, this unpaired character induces sterility, although how it has this effect remains unknown. Further in the species-hybrids forms intermediate ("Zwischenform") between those of the two parents occur. These intermediate forms are fixed and do not assume atavistic characters.

Thus species-crosses appear to produce intermediate hybrids, but it is difficult to verify their occurrence because in the F_2 (second generation), sterility usually makes its appearance.

As has however already been stated, BAUR admits that alternate inheritance occurs in species-hybrids.

PLATE considers that nature has a tendency to transform alternate inheritance into intermediate inheritance.

GROSS, on the other hand, is of opinion that alternate inheritance is exceptional, even in races with Mendelian inheritance and regards intermediate inheritance as the basis of the origin of new species. He considers that variety with intermediate inheritance, and not variety with Mendelian inheritance, is the true starting point of new species.

According to RABAUD, the two phenomena, complete dominance in conformity with the rules of alternate inheritance, and the production of intermediate forms are only two modes of the same process, and he regards the contradiction, which students of genetics believe to exist between the two different forms of inheritance as limited to the external appearance and devoid of real foundation.

The solution of this problem will be discovered when the investigator instead of simply stating that the colour *A* is dominant, will take the further step of analysing this character. A new path in this direction has been opened by chemical analysis and the above statement of RABAUD is doubly true if formal analysis is followed by practical analysis. In this connection may be quoted the recent opinions of PIGORINI and MUNERATI respecting chemical analysis in connection with their researches on silkworms and sugar-beets respectively.

DARBISHIRE introduced chemical investigation into Mendelian researches on peas in order to determine certain characters that cannot be discovered by any other means.

MUNERATI recalls other researches of the same character conducted by BLAKESLEE and PARNELL and gives an interesting account of his own observations on sugar beets. In the populations obtained by crossing white-skinned sugar-beets with forage-beets having pigmented skins, individuals were found which possessed the distinct characters of the sugar beet type properly so-called (white skin and pulp, and sugar-beet shape). These hybrids would certainly have been classified among the individuals of sugar-beet type by the expert in morphological genetics, that is to say, as pure-bred specimens.

but the chemical test revealed their hybrid origin and showed that the forage-beet characters were only masked.

Mention is also made of the interesting observations of PIGORINI, which show that the phenomenon of the coloration of the silk-worm cocoon is probably by no means as simple as would appear. By means of spectrophotometric investigations, PIGORINI succeded in showing that the so-called white cocoons contain pigments, and that in order to decide the question of dominance, the intensity of the character must be estimated.

However, as a rule, according to the principle already enunciated by GODRON, species-hybrids are of fixed intermediate character; in this they differ from race-hybrids, where in the few cases in which they occur, they are always homoeomeric.

LOTSY has tried to give a cytological explanation of the different behaviour of the hybrids of the first generation; he suggests that race hybrids following Mendelian laws are duplex forms in which all the chromosomes are paired, whereas there are many hybrids of semi-duplex type in which the chromosomes are not paired, since the number of the paternal and the maternal chromosomes is not the same. If it be admitted however that the semi-duplex forms are fertile, this explanation of LOTSY does not hold good.

Mendelism has had the effect of causing the value of species and of varieties to be re-examined from the standpoint of genetics.

Many discussions have arisen as to the scientific concept of race, but most authors agree in regarding a race as an aggregate of individuals possessing the same power of transmitting the typical morphological and physiological properties of the same race, that is to say, they are homozygous as regards these properties. According to the recent definition adopted by MALSBURGS at the International Agricultural Congress, a race is composed of a population with the same genotypes, which may however differ as regards phenotypic or apparent characters, without making transmissible the somatic qualities of the several individuals (the modifications of the race qualities) or the phenotypic divergences due to environment, or ecologically acquired.

The tests of fertility and sterility in heterozygotes were regarded by CUVIER as the best means of distinguishing true species from false. This test is also adopted by Italian technicians, who reserve the name of hybrid for the sterile offspring of two species, while they term the fertile product of two races, or varieties, a half-breed ("meticcio").

Although this nomenclature is practical from a certain standpoint and when applied to the small number of domesticated animals, it could not be generally adopted (GHIGI).

In the groups of animals that have already been studied, the crossing of systematic species of the same genus, frequently gives rise to fertile heterozygous individuals, whereas sterile heterozygous individuals often result from crossing different genera and even families.

The reason of the infertility of hybrids has yet to be determined. According to POLLS and others, it is attributable to a disturbance of the phenomena accompanying the maturation of the sexual cells. POLLS gives the name of *toconoti* to hybrids in which the germ-cells arrive at maturation, while he terms *steironoti* all hybrids whose germ-cells abort before maturation, which would seem to occur when different species are crossed.

The continual fertility of certain plant hybrids has already been admitted by NAUDIN. BROCA calls hybridisation resulting in fertile hybrids, eugenesis, and applied the term dysgenesis to hybridisation producing sterile hybrids.

Modern genetics have still to show in many cases whether sterility depends upon disturbances due to different numbers of chromosomes, or different properties of the plasm or to both causes.

As HAECKER remarks the number of chromosomes in some groups of animals is relatively uniform. It is the opinion of the author that in these groups it is easier to obtain fertile hybrids even between species, whereas sterile hybrids would more readily be produced where the number of chromosomes in the species crossed is different. The recent experiments made by NIKOLAEVA in crossing species of *Avena* wtih different numbers of chromosomes show that, at any rate in the case of plants, this hypothesis is more probable than LOTSY's theory of chromosome arrangement. NIKOLAEVA's suggestion would explain why fertile hybrids are more common in certain groups of plants and animals than in others. There is no doubt that a series of cytological researches in this direction would be of signal importance (1).

1) The cytological researches on the behaviour of the chromosomes in mutants are very exhaustive. This structure does not apply to the interesting and important investigations resulting in the discovery of triploid and tetraploid species in which the number of chromosomes is trebled or quadrupled; in other words, it is not desired either to deny or affirm that amphimixis may exist in this manner. It is obvious that from the union of two egg-cells

Naturally, it is quite possible that, in other cases, not only the number of chromosomes, but also the chemical composition of the plasm is concerned.

The extraordinary vigour (heterosis) of hybrids incapable of reproducing themselves may at first sight seem a contradiction but can be explained from the cytological and physiological standpoints. It is possible that the excitement of the plasm which endows the hybrid with vigour may yet be accompanied by a disturbance of its germ elements and an alteration in the nucleo-plasm relation. Perhaps some light may be thrown upon these problems by the study of the internal secretions of hybrids.

Some investigators wish to give the name of hybrid to the products of species-crosses, while reserving for the products of race-crosses the term half-breeds, but since it is often very difficult to distinguish species from races, this distinction becomes as HAECKER says a *petitio principii*; therefore it is better to define a hybrid as the product of crossing of forms that have a different descent, so that hybridisation may be described as the reunion of two germ-cells that do not contain the same hereditary outlines (CORRENS).

Physiologically a hybrid is a heterozygous organism no matter what its genealogical descent may be; therefore, as JOHANNSEN says, the purely physiological definition possesses advantages over the genealogical definitions previously employed. DE VRIES by means of his mutation theory of discontinuous variation tried to explain the difference between species-hybrids and race-hybrids.

Mendelism, in so far as it appeals to genotypic differences, has brought about the re-examination of the value of evolutionary theories which, like the mutationism of DE VRIES, connect the variability of species with the theory of the transmission power of the germ.

According to DE VRIES, a mutant possesses one hereditary quality

tive cells with an unreduced number of diploid chromosomes, tetraploid species, for instance, are obtained. The point that is not clear is the behaviour of the chromosomes derived from parents possessing chromosomes that differ considerably in number and of which one lot does not undergo reduction division. It is only necessary to refer to the various authors in order to see the uncertainty that exists regarding the interpretation of the numerical arrangement of chromosomes in intermediate hybrids. It is evident that a hybrid capable of transmitting new characters to its offspring can result from a new regular arrangement of chromosomes, but that fixed intermediate hybrids can be produced, as LOTSY believes, from uncertain arrangements of chromosomes seems to be very doubtful. The fact that numerous hybrids with different assortments of chromosomes prove sterile owing to evident malformations arising during the maturation of the germ-cells, which suggests that no general regulation of the chromosomes has taken place, is certainly in favour of the point of view here expressed.

more or less than the species, while a variety has the same number of hereditary qualities as the species, but in the variety, one of these qualities is latent.

Every progressive mutation is based on two occurrences, the formation of a new hereditary quality and the activation of this quality. In variety-crosses, all the qualities are paired and therefore the crosses are called bisexual as in the Mendelian hybrids.

On the other hand, in crosses between mutants, the number of the qualities differs in the two parents and therefore unisexual crosses are obtained. As DE VRIES says, bisexual crossing gives the idea of complete symmetry, since all the units or characters unite in pairs. In unisexual crosses, one or more units remain unpaired. It must be remembered that MENDEL's law applies to the bisexual cross of DE VRIES, not to unisexual crosses.

The mutation theory of DE VRIES has been weakened by the unknown origin of *Oenothera Lamarckiana*. If the views of DE VRIES are correct, this plant should be regarded as a pure species, but according to the opponents of DE VRIES, it is merely a fertile hybrid, while the illusion of mutation is caused by the re-appearance of recessive forms. Such an occurrence was actually observed by TOWER in the case of crosses of *Leptinotarsa*.

Here there is clearly a vicious circle, because while the Mendelians have tried to explain by means of the mutation theory certain phenomena connected with the laws governing inheritance in crosses, the laws of hybridisation are called upon to furnish an explanation of the actual nature of mutations and give them a special significance and a limited value.

When a new quality arises and at once becomes active, a case of progressive mutation arises, but if the new character is latent, the mutation is retrogressive.

Regressive mutations, where one factor is lacking, are much commoner than progressive mutations due to a newly-formed factor, or degressive mutations caused by the activation of a latent factor. Mutation can be regarded as the consequence of a chemical modification, or the more or less complete disappearance of a factor, or on the other hand, as due to the formation of a new genotypic unit. As regards a mutation involving the hereditary particles or genes (the idiomutation of PLATE), DE VRIES gives the name of species to any form produced by the neo-formation of a gene, while he reserves the term variety for all forms produced by the transformation of an already

existing gene. Many mutations are fixed, that is to say, they are transmitted without attenuation, but oscillating mutations also exist.

Unstable mutations with imperfect dominance are extreme cases of variable mutation ; an instance of these is the polydactylism of guinea-pigs and of fowls. Thus Houdans and Dorkings are characterised by the presence of a fifth toe due to the reduplication of the pollex ; hence the above breeds are known not to be fixed. Similar unstable mutations are the bi-lobation or tri-lobation of the caudal fin and the exophthalmia observed in some varieties of Chinese fish. Although these varieties of fish have been reared for centuries in the Far East, it has never been possible, even by means of the most careful selection, to fix these characters.

PLATE is of opinion that in these unstable varieties, there are two opposing characters with an alternate change of value.

Mutations in species of plants that stand self-fertilisation badly (maize, rye, etc.) are not, as BLARINGHEM notes, rarer than in other species, but the conditions of grain formation prevent natural, or artificial selection and render line separation difficult, if not impossible. The hindrances are naturally much less in the case of plants such as tobacco that can equally well be self-fertilised or crossed.

DE VRIES has thoroughly discussed this question in his study on propinquity. The isolation of mutants is greatly facilitated in the case of self-fertilised species as is shown by the existence of a large number of garden varieties.

When the mutation gives rise to a variety properly so-called, it is not difficult to get rid of the mutant character, which becomes a recessive in two generations if a variety is crossed with the original species ; this was found by JOHANNSEN in his experiments on beans. Though mutants behave like elementary species, the results are less clearly marked than in the case of such species and the return to the species form is generally slower. Thus, DE VRIES found that the pollen of the new species, *Oenothera lata*, aborted and the plant could only be propagated if fertilised with the pollen of *Oenothera lamarckiana*. Most of the mutations occurring in higher animals belong to the class represented by the mutation observed in the Mauchamp Merino sheep, since the change effects a unisexual individual and usually one only. In order to get rid of the new character, it is necessary to apply the law of segregation, to select the recessives, or failing these, the hybrids that possess one of these new characters.

The selection of hybrids is very different both as regards the

method employed and the results obtained. New hybrids (hybridomutations, or amphimutations), when reproduced by seed are rarely stable, the law governing their return to the original condition operating more or less potently according to climatic conditions, fertilisers, etc., and it is difficult to find conditions of equilibrium that allow such combinations to remain unchanged (BLARINGHEM). The selection of hybrid lines is only possible when the object in view is clearly defined and, as far as possible, limited.

In hybridisation however, it is necessary to distinguish clearly, crosses between two species (DE VRIES's unisexual union), where the hybrid is fixed and of very limited fertility and the more usual type of cross, viz. that between two varieties, differing from one another only in respect of two opposing characters of which one is dominant and the other recessive, so that their progeny present all the combinations regulating Mendelian inheritance.

In the latter case (stock breeders' crosses), the fertile products are termed half-breeds. Even here, so-called reversion phenomena occur, as indicated by MENDEL's law, with the predominance of one type over the other and a return to one of the pure breeds.

DE VRIES's theory, in so far as he considers variability to depend solely upon the genotypic variations of the germ, reduces the value of selection in the Darwinian sense, for the apparent race improvement obtained by the selection of a group of individuals is only due to the fact that this assemblage (called a population) is not genotypically uniform.

The idea that the Linnean species includes a large number of elementary species has already been accepted by JORDAN in his valuable studies on *Draba verna*; hence elementary species are also called "Jordanian species". Later, it was seen that the same small species is made up of a larger or smaller number of lines.

JOHANNSEN calls the group of individuals resulting from the fertilisation of a homozygous individual a "pure line" (genotype), in contradistinction to the "population" which is a "phenotype" or an assemblage of individuals without genotypic unity. One phenotype may contain numerous pure lines, or biotypes. The variability curve of every pure line is much slighter than that of the phenotype. Pure lines may arise in organisms reproducing themselves by self-fertilisation, by means of parthenogenesis, or by asexual methods of reproduction, such as budding or division. Instances of such pure line formation is seen in bacteria and *Cyanophyceae*, organisms that

propagate themselves asexually, and in some parthenogenetic apogamous plants. A homozygous race produces a pure line as a result of self-fertilisation or vegetative reproduction, and pedigree cultivation.

JOHANNSEN's theory has modified accepted ideas respecting the regression of fluctuations, or GALTON's law of regression, according to which the average in the progeny of extreme variations tends to approach the general average of the population. JOHANNSEN has shown that mass selection thus applied to all the individuals of a population which have the desired character displaces the average, because the population is a mixture of pure lines each having its own curve, so that when all the lines are taken together, a sum of the curves is obtained.

Mass selection therefore offers no advantages, because if success in obtaining a majority of pure lines characterised by any extreme given variation is reached, the general mean will be slightly displaced, but among the offspring there will be many individuals which do not possess the desired variant.

JOHANNSEN has shown that selection acting upon a population can displace the mean value of a character in a pure line. In other words, according to JOHANNSEN, selection in the case of a pure homozygous line, would have no effect. JOHANNSEN is of opinion that Mendelian unit factors are relatively constant and stable in different combinations, and that the variability occurring in a population that constantly propagates itself by means of cross-fertilisation is largely due to the segregation and recombination of these factors. When self-fertilisation is continuous in a heterozygous population, homozygosis is definitively attained and the primitive variability largely disappears. Potential variability is synonymous with genotypic impurity (HAGEDOORN).

GROSS is decidedly opposed to this concession of JOHANNSEN and says that if JOHANNSEN's views in this respect were correct, genotypes would be found (pure, isolated races) and not phenotypes in nature, whereas just the contrary is the case. According to GROSS, selection does not isolate pure lines, but only destroys some of them. On the other hand, JOHANNSEN's theory is naturally accepted by the neo-Mendelians and the mutationists, since it shows the new formation of biotypes by mutation, to be the one source of organic evolution.

Certain fluctuations which are regarded by the upholders of the efficacy of selection as the expression of a single factor, or a single hereditary unit are on the contrary, due to the separate or combined

action, of various factors working in the same direction (intensifying factors) or in an opposite direction (inhibitory factors), or in an undefined direction (modifying factors), so that, as MUNERATI expresses it, the sole office of selection is to bring about a different orientation and a different combination of the factors working in cooperation.

When the breeder carries out selection on a population, i e., on an assemblage of individuals which present a perpetual and infinite re-combination of Mendelian factors, he actually only chooses a " combination of factors " and renders it homozygous by means of inbreeding, which is naturally more quickly effected in the case of self-fertilising species.

The question is entirely different when the breeder isolates true mutations, or sports.

Finally, as has been said, hybridisation with the choice of the desired re-combination of factors, which can be continued until a homogeneous product is obtained, provides a new source for the selectionist.

The aim of selection and of hybridisation is the isolation of homozygous biotypes, but according to LOTSY, homozygous individuals in the strict sense of the word do not exist.

JOHANNSEN subsequently mentioned the discontinuity of constitution in biotypes. Like the chemical molecule, biotypes vary in structure. If it is admitted that the constitution of a biotype may become fixed, it is also admitted that new species may be formed (UHLMANN).

In the meantime, JOHANNSEN has applied the term of pure line to the progeny of a homozygous plant capable of self-fertilisation. In cross-fertilisation, according to FRÜHWIRTH himself, there is no question of pure lines, but of a mixture of lines from which it is necessary, by means of selection, to isolate pure lines.

CASTLE is doubtful whether a pure line can ever have been obtained in any of the present races of animals or plants and ROOT questions how far so-called pure lines are really pure and whether the enigmatic origin of biotypes is not concealed.

It cannot be denied that the extreme conclusions of neo-Mendelism lead back by a vicious circle, to a denial or depreciation of the value of evolution in so far as once the importance of selection is rendered problematic, and doubt is cast upon the formation of new genes, evolution is reduced to the recombination of factors and becomes a preformistic theory. This is the Batesonian exaggeration!

The criticism of modern scientific thought, leaving out of account any consideration of the advantages accruing to practical agriculture from a better knowledge of the laws of hybridisation, leads therefore to a thorough examination of the theories of MENDEL and of DE VRIES, which meet at some points and both alike hesitate before the lack of any clear knowledge of the formation of the unit of inheritance.

No one would wish to deny the great merits of MENDEL and the importance of the scientific movement based on the laws formulated by him respecting inheritance in hybrids. These laws, in spite of very numerous exceptions, have still to be taken into account.

MENDEL himself would not have incautiously wandered into the labyrinth of the doctrines upheld by the neo-Mendelians, who make the great mistake of piling hypothesis on hypothesis in order to explain apparent exceptions to the laws of MENDEL which appear to us of little importance. The number of biologists who have enrolled themselves as supporters of the crossing-over theory is truly remarkable. Despite the convinced Mendelians and the cytologists who think to follow the fashion, the author is convinced that crossing-over does not exist and is a mere illusion.

In all the course of his cytological studies, he has never seen the breaking and rejoining of the segments of a chromosome, and such phenomena only exist in the phantasy of their inventors.

Moreover the interchange of the genes could be accomplished in a much simpler manner. The position should not however be assumed of denying that the chromosomes have any influence upon the phenomena of heredity, since as recent researches have proved, quite new biotypes may arise from a new combination of chromosomes which is sometimes, but not always (ARTOM), due to hybridisation.

A new position as regards the relations between hybridism and the evolutionary theory has lately been taken up by RABAUD.

He is of opinion that amphimixis is certainly (as WEISMANN believed), a source of variation, but not the sole source, in the sense of facilitating new combinations of characters and determinants (which is WEISMANN's theory). RABAUD regards the variation induced by amphimixis as due to actual interaction and in necessary and constant function of the medium. A variation caused by crossing would be derived from the complex of organism, medium and environment. There would be a " susceptible period " in the evolution of the gametes during which the influence of the medium would make itself especially

felt ; this is overlooked by MORGAN and the neo-Mendelians in general. To put it is other words, it is a question of a parallel influence acting at the same time upon the germ and the somatic cells.

The phenomena of dominance and of recessivity are sometimes investigated morphologically only and not physically ; the Mendelian laws are also applied, as MORGAN states to the least important characters of individual variation and not to the typical variations of the organisation so that, while Mendelism limits itself to the analysis of trivial phenomena, an attempt is made by means of neo-Mendelism to formulate a general theory of evolution and thus solve the most obscure problems relating to the formation of types.

When, however, an explanation of biotypic discontinuity is sought in a comparison with the building up of the chemical molecule, and this discontinuity is regarded as pre-supposing a continuity of phenomena (UHLAND), then for the biological atomistic theory must be substituted a dynamic conception and Mendelian inheritance limited to a plasmatic inheritance (DURKEN), which leads to the problem of the origin of the new genes.

On the other hand, the genes should be investigated from the dynamic standpoint and not considered merely as material particles, as has been done by UEXKÜLL and REINKE.

The doctrines of the neo-Mendelians are also at variance with the chemical theory of genes, for if the exciting and the inhibitory action of a factor is chemical, the micromeristic concept, which is purely morphological, and not dynamic, is at once left out of sight.

To attempt, as is the habit of the neo-Mendelians, to analyse morphologically the inheritance of colour is a serious mistake, since colour more than any other character requires chemico-physiological analysis.

From the evolutionary standpoint, neo-Mendelism takes refuge in the preformistic doctrine, because it has nothing to say regarding the origin of the genes or of the unit-characters ; therefore the theory of their recombination so dear to the hearts of the neo-Mendelians resolves itself into a sort of kaleidoscopic diversion.

Just as the neo-Mendelians can say nothing as to the origin of new genes, so the mutationists can give little or no information respecting the origin of lower species. The writer is not alone in his view, for REINKE, the able theorist and celebrated botanist, is equally unconvinced. As neo-Mendelism can find no valid explanation of the origin of new genes, it falls either into the Batesonian exaggeration of bolley-

ing evolution to be due solely to the loss of factors, or else turns to LOTSY'S theory according to which hybridism is the fundamental factor in organic evolution, whereas it is well known that if it is difficult to believe hybridism to be the only source of variation in plants, such a hypothesis would be more absurd and incredible in the case of the evolution of animals.

At a certain point in genetics, both the selectionist and the hybridiser will, it is true, seek to forget the tangle of hypotheses and try to extract from the mass of biological theories some practical rules for the improvement of breeds.

The biologist however when he wishes to draw any general conclusions, finds himself beset by the same problems and doubts that assail him when he strives to estimate the value of the results obtained by selection, or hybridisation, and to explain the reason for the steps taken.

FRUHWIRTH distinguishes the various methods of selection as follows :

(1) *Selection for improving the race.* In this type of selection, advantage is taken of the deviations commonly termed fluctuations, or small individual variations.

(2) *Selection of new types*

(*a*) by means of selecting spontaneous variations of a morphological character (WALTHER'S genotypic selection) ;

(*b*) by separating groups of types (genealogical or pedigree cultivation methods) ;

(*c*) by hybridisation. WALTHER divides this method under two heads : BURBANK'S promiscuous crossing and Mendelian crossing ;

(*d*) by vegetative hybridisation.

When cereal improvement is the object three kinds of selection are practised : the selection of a group of types (mass selection), repeated selection (RIMPAU'S method), or HALLETT'S method which consists in choosing the best grain from a head and then making repeated selections. The success of HALLETT'S method is due, according to WALTHER, to the fact that the genotypic constitution frequently corresponds to the phenotypic character.

The followers of JORDAN and JOHANNSEN are however of opinion that this method depends, for instance, upon the chance of at once meeting with an ear belonging to a small species and possessing the required characters. It was NILSSON in particular who, on recognising that the ordinary method of selection gave unsatisfactory res-

alts, renounced mass selection (viz., using seeds from different individuals).

According to the methods of NILSSON and of the Jordanian selectionists, of which the precursors are LE COMTEUR, SHIRREFF and VON LOCHNOW, they, unlike the preceding workers who considered repeated selection necessary, have worked and still work on the basis of a single initial selection followed by rapid propagation without the repetition of any selection in the successive generations (TODARO).

TODARO himself says that a distinction should be drawn between self-fertilising species (wheat, oats, barley, rice), and species in which cross-fertilisation is the rule (rye, maize), so that it is necessary to substitute for a single selection, a so-called "purifying selection" (*selezione di affinamento*) based on repeated selection.

The successes obtained by means of hybridisation and selection have been considerable, but their importance has sometimes been exaggerated, not so much by stock-breeders who have long recognised the instability of hybrids, but by agriculturists.

Only a few authors possess the courage of MUNERATI, who has admitted the many delusions to which conscientious experimentalists may fall victims. For this reason, MUNERATI's short memoir "*Sul probabile meccanismo della ereditarietà nella odierna barbabietola di zucchero e sulla possibilità di un ulteriore perfezionamento del tipo*" (The probable mechanism of inheritance in sugar-beets to-day and the possibility of further improving the type) deserves special mention, because in this book, the author shows that, if it is true that from 1910 until the present day, seed selecting firms of the first rank have annually distributed new varieties or races, said to be capable of making perceptible steps forward from time to time, these prophecies have not been fulfilled, as is shown by the average unit of production per hectare. It is however true, as TODARI says, that MUNERATI's scepticism is the result of the difficult material on which he has worked and that his conclusions do not necessarily apply to cereals, but the author has himself known cereal-cultivators to speak of pure races, even in case of amphimutations between different species of *Triticum* and different species of *Avena*. It is necessary also to take into acount the fact that many so-called varieties of *Triticum vulgare* are really species (HAGEDOORN), so that HAGEDOORN suggests that a trinomial nomenclature should be used for them.

The question of the different methods of selection and of hybridisation has aroused special interest and been the subject of lively

discussions, especially in the field of wheat-cultivation. The heads of the two schools of selection and hybridisation in Italy are respectively TODARO and STRAMPELLI. Biologists know that STRAMPELLI'S clever applications of MENDEL'S theory were based on the suggestions of CUBONI and upon the results abtained by VILMORIN with the hybrid known as the " Unlodgeable ". It may however be true that the admirers of STRAMPELLI have done him a disservice in unduly exalting the value of certain wheats, like Carlotta Strampelli, while they forget the original merits of Rieti and leave out of account the inconstancy of many cereal hybrids. STRAMPELLI who is a very able experimentalist, would possibly be more prudent to devote his attention to making researches in experiment fields, since it is necessary to take into account the local races that have been improved by countless years of selection, and also to consider the quality of the soil.

CAMPBELL refers very opportunely in this connection to the analytic researches of JOULIE, which show that different varieties of wheat have very different capacities for absorbing nutritive elements, so that certain varieties can satisfy their requirements on soils of a composition that would fail to support others. Thus environment must be taken into consideration, and eugenics must not neglect eutechnics. MUNERATI remarks suggestively that in comparing the possibly larger yield of the pure race as compared with that obtained from the mixture of biotypes, it should be remembered that the biotype generally finds itself ill-prepared to contend with various adverse conditions such as, for instance, those presented by soils of different compositions.

When thousands of homozygous races of wheat are mentioned, it is difficult not to be sceptical, partly on account of the difficulty of defining exactly in what a pure race consists after all the surprises caused by atavism, reversion and segregation, the refuge of Mendelians when it is necessary to explain any exceptions, and partly because it is not easy to share the opinion of PUNNETT who tries to rescue the conception of the pure race, not by referring to the uncertain data afforded by the offspring, but on the apparently more solid grounds of segregation of characters in the gametes. A problem that is still more difficult to solve may be set, viz., the supposed fixity of hybrids and the question may be asked whether this stability rests on any more solid foundation than HAZDY'S speculations which are quoted by PUNNETT himself to prove that stability in hybrids only occurs in the case of a recessive character. If the neo-Mendelians have no other

arguments to demonstrate the constancy of hybrids beyond those furnished by the very theoretical formulae of HAZDY, these are not sufficient to free from suspicion the thousands of homozygous races obtained by hybridisation.

Cereal-culture has two problems to solve at the same time as genetics, viz., resistance to diseases, especially to rust, and resistance to lodging. In the writer's opinion however it has not been scientifically proved that hybrids can be resistant both to diseases and to lodging. Even if rust-resistance is a Mendelian recessive character, (BIFFEN, STRAMPELLI) what is the character of resistance to lodging? It can hardly be believed to be an individual character in the Mendelian sense of the term, but a complex of characters that represents the whole individuality of the race. More probable is the view of TODARO, whose opinion is based upon the researches made by GARBER and OLSON, of the Minnesota Agricultural Station, for the purpose of determining whether lodging in cereals is correlated with some morphological character. It would appear that the causes determining lodging are so complex and the factors so numerous and possess such a different value in different races that none of them seem to be intimately enough connected with this property to be of any appreciable assistance in solving the problem. There is no justification for speaking of pure, lodging-resistant races. Therefore although PANTANELLI considers hybridisation to be the only rational means of freeing maize from the rust scourge, he yet recognises that no scientific basis for work of this order has yet been laid down.

Although in principle, he mistrusts the alleged fixity of hybrids, he does not put forward any new theory. NAUDIN before MENDEL made the instability of hybrids the foundation of his theory. There are also modern evolutionists who feel doubtful as to the fixity of hybrids. BLARINGHEM recently said " At the present time, it must still be admitted that in the different cases where this fixity seems to be well established, this stability is only apparent. Mixed sexual elements exist, but they are unstable in so far that the lines derived from them are subject to unexpected relapses and are always characterised by reduced fertility. To speak frankly, the production of mixed germs that retain the mixed character is exceptional ; as a result of hybridisation, apparent pseudo-species may reproduce themselves along different paths for some years, but sooner or later, their propagation in time and space will be followed by the re-appearance of the more stable ancestral types ; they must be regarded as similar to the chem-

ical complexes studied by PASTEUR which are conditions of equilibrium between the molecules, and not new molecular constructions ".

Illusions are also encountered on passing into the field of the hybridisation and selection of breeds of animals. In this connection, the writer's collegue PIGORINI recalls very aptly an observation made by PASQUALIS to the Silkworm Congress held at Montpellier in 1874, which still holds good. " We have been acting like the lady of the XVIII century (1773) who had begun the selection of white cocoons and was forced to bequeath her labour of Sisyphus to Geoffry SAINT HILAIRE who even by the middle of the XIX century, had not yet succeeded in fixing definitely the required character in the progeny. Indeed, what improvement of any importance has been obtained by talking of pure races ? Are the cocoons of these races better than those obtained ten or twenty years ago ? Some improvement has certainly been made in the size of the light Japanese breeds but is this the effect of selection, or is it not really due to the more favourable environment in Europe, or to greater care in rearing ? Actual improvement has certainly been made, but it may well be asked whether this is not to be attributed to crossing, rather than to selection, and whether, at all events by the more careful choice of the races which it is desired to cross, it would not be possible to improve the quality of the hybrids still further ". On passing from silkworm-rearing to stock breeding yet another disappointment must be recorded.

To be quite clear : in order to be sure of success in hybridisation or selection, it is necessary to work on pure races. What are the pure races used in stock-breeding ? The author agrees with KRONACHER, a stock-breeder of great experience who declares that it is impossible to investigate the history of the commonest breeds of animals without meeting with lacunae and doubtful cases.

In order at least to protect the knowledge that may be acquired in the future, it would be necessary for all States to make an International Convention for the registration, control, and codification of all new races introduced into the different countries. This is a piece of work that could well be undertaken by the International Institute of Agriculture.

The theoretical and practical difficulties are very numerous, both as regards the breeds crossed and their hybrids. These are the very difficulties that have prevented the solution of the origin of species.

The improvement of races of agricultural plants and of domestic animals is up to a certain point, a matter depending upon the state of

biological knowledge. There are in truth schools of selectionists, just as there are schools of evolutionists, while the antithesis between the theories of LAMARCK, DARWIN and the mutationists influences, as has been shown, the various methods of selection and hybridisation.

Thus at the Svalöf Station BRUNIN of Neegard applied the Darwinian principles to selection, whereas according to CUBONI, the adoption of NILSSON's contrary method would have proved the fallacy of DARWIN's theory.

The selection methods themselves will necessarily differ according as the question is one of working upon species known or believed to be collective, or upon small species, or pure lines. There will naturally be a difference between agricultural and stock-breeding methods, seeing that not all species of animals are collective species, and self-fertilisation though it occurs naturally, or can be artificially practised, in the case of many plants is an exceptional phenomena among animals.

If the differences between agricultural and stock-breeding methods are to be considered, it would be necessary in the first place to investigate the problems of inbreeding and out-breeding, which has already been brilliantly carried out by EAST and JONES.

Inbreeding lessens the fertility and the constitutional strength of breeds of animals, and even inbreeding requires much longer time and entails greater expense than obtaining homozygous plants, which in many cases can be self-fertilised.

As regards the question of insuring the fixity of the product obtained, the agriculturist finds himself again in a very different case from the stock-breeder. Most varieties of fruits and flowers are well known to be unstable if raised from seed, although they retain their characters when propagated vegetatively, a mode of reproduction that is impossible in the case of animals.

As has been previously mentioned, the first generation hybrids of animals are of great importance and outbreeding is of industrial value, even if the hybrids of the first generation frequently prove sterile. In a recent work, FRATEUR points out the difficulty of interpreting from a genetic standpoint the new forms of the first generation, whether they be intermediate forms (half-breeds), or new or koinogenetic forms.

For this among other reasons, in spite of the consideration of the vigour of the hybrids (heterosis), which according to SHULL is due to heterozygosis, and of the interesting field it opens to Mendelian re-

search, heterogenous breeding has never been so largely practised among the breeders of animals as by botanists and agriculturists.

There is no doubt however that neither the stock-breeder, nor the agriculturist should neglect the study of these closely related problems or forget the successes that have been attained in both fields of experiment. Another unknown element both in agriculture and stock-breeding, although it is a matter connected with the study of genetics and evolution, is the origin of agricultural plants and of domestic animals.

Indeed, a polyphyletic theory, at least as regards the origin of many of our domestic animals, has gradually been substituted for DARWIN's monophyletic theory related to the factor of selection and of individual variation, that formed the subject of one of his most memorable works, viz. that dealing with the origin of plants and domestic animals.

An intermediate position was taken up by BARON with his theory of the existence of polymorphic zoological species representing the different groups of domestic live-stock. Although BARON's theory would not bear the light of modern criticism, his scepticism seems justified.

It is true that stock-breeders and agriculturists both distinguish three classes of races, the natural, the improved, which is also called the transitional, and the cultural, or specialised (BOUCHER), and though they shade off by imperceptible gradations into one another, it is very difficult again to reach what SETTEGAST called natural and NATHUSIUS primitive races. According to SANSON, the improvement of races is not a matter of their specialisation, but of their exactly fulfilling economic requirements, while BARON states that the value of a domestic animal depends less upon its specialisation than upon its adaptability to environment.

The problem of the origin of domestication, if mystical and religious theories are left out of account, is as open a question as that of the origin of species.

Therefore the theories of genetics, like those of evolution, oscillate between the opposite poles of the absolute and relative influence of the environment and of the absolute and relative influence of the germ-plasm.

The concept of mutation therefore does not merely include the mystery of the paths of organic progress, but also the mystery of the origin of agricultural plants and of domestic animals.

The agriculturist, no less than the stock-breeder, finds himself confronted with the enigma of the origin of races; while the so-called purity of races is a myth, as investigation can nearly always show. Since this difficult problem is intimately connected with the central problem of evolution, the same doubts and difficulties at times assail both breeders and evolutionists, and the common problem of organic inheritance confronts the enquirer at the ultimate stage of all research and every theory.

But it may be asked what is the road which is still to be travelled. To this question the reply may be given that genetics must be regarded as a union of sciences, that races should be studied also in their relation to the soil and also by means of the necessary cytological, histological and physiological researches which, if they were brought into harmony with one another, would lead much further forward than any unilateral investigations.

This is a field of international scientific collaboration, for the initiation of which the International Institute of Agriculture, recalling the International Conference of Genetics which took place in Paris before the war, might invite (in the discussin of the necessary preliminary understandings) biologists and genetists of all nations to a fresh authoritative Conference with more ample scope.

In the view of the author the recommendations to be put forward for the approval of the Conference, with special reference to the genetic movement viewed internationally, would be the following:—

(1) That monographs should be compiled for every State giving a historical account of the species and races of animals and plants that have been naturally or artificially introduced;

(2) That the introduction into the State of any such new species or race should be notified;

(3) That a coordinated study of the variations occurring in recently introduced breeds should be drawn up and also a Code of International Rules respecting the exchange of new breeds;

(4) That a scheme of International genetic work should be drafted so that the races may be studied under every aspect, and the work of the various scientific and agricultural Institutes coordinated;

(5) That prizes (of a value to be determined subsequently) should be offered for special theses, in order to encourage the progress of genetics and bibliographical researches connected with the problems

of the origin of the various races of agricultural plants and domestic animals ;

(6) That a Permanent International Committee for Genetics should be established with subsidies from the various States and an International office of Records.

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THE SEX-RATIO AND THE QUESTION OF ITS CONTROL.

The sex-ratio.

The sex-ratio is the relative numerical proportion of the sexes within a group. In any bisexual species there must be a sex-ratio at all times after sex is determined, but it is convenient to take conception, birth and maturity as the three salient points in the life-history of the individual at which to consider the sex-ratios, as these three stages are known as the primary, the secondary, and the tertiary sex-ratio respectively. The secondary sex-ratio is measured by taking the number of males per hundred females born, and is the one usually considered. The primary sex-ratio is a demonstration of the sex-determining mechanism in operation, while the tertiary will provide an estimate of the post-natal survival value of the two sexes. Since an exact knowledge of the processes involved in the establishment of the sex-ratio may possibly lead to the development of breeding practices by which the stock-breeder may control at will the production of the progeny of one sex rather than the other among his stock, the subject possesses more than a purely scientific interest. To the dairy farmer or to the egg farmer any striking increase in the number of males produced by his stock must foreshadow disaster, whereas any notable increase in the relative number of females must be highly advantageous.

A review of the established facts of sex-linked inheritance, by which a character, or characters, of a parent are transmitted to a child of the opposite sex or to some of its grand-children of the same sex, allows of no escape from the conclusion that sex is determined at the moment of fertilization, that there must exist a mechanism which tends to preserve the production in every new generation of equal numbers of males and females, and that this mechanism is inherent in the gametes in virtue of the production by one sex, the female in the *Abraxas* group, the male in the Drosophila, of two kinds of reproductive cells, male-producing and female-producing respectively.

Cytology, in revealing the sex-chromosome differences in the two sexes, has demonstrated this mechanism and has clearly shown that in the absence of disturbing agencies the sex-ratio should be 1 : 1, since one sex is constitutionally heterogametic, elaborating two sorts of gametes in equal numbers, the other homogametic. It is established that in the case of the domesticated mammals, the male is the heterogametic sex ; in the case of the domestic fowl, the female.

However, the sex-ratio, though fairly constant and not far from equality, is distinctly variable and rarely coincides with the expected 1 : 1 ; in view of what is known concerning the sex-determining mechanism it is necessary to examine this variability and to explain it.

The sex-ratio varies with the species. The secondary sex-ratio of most mammals has not been determined experimentally, for with few exceptions the mammals are unsuitable for experiments on a large scale and that which is known has been culled from the different breed registers. The following data have met with general approval (Cuénot (1), Schleip (2), Leneossek (3), Hertwig (4), Doncaster (3), *et al.*) :

Man	103-107	: 100	Pig.	111.8	: 100
Horse.	98.3	: 100	Rabbit . . .	104.6	: 100
Dog	118.5	: 100	Mice	100-118	: 100
Cattle.	107.3	: 100	Fowl	95.4-94.7	: 100
Sheep.	97.7	: 100	Pigeon . . .	115.0	: 100

The sex-ratio varies with the race, breed, and strain, and there are reasons for holding that the production of a profoundly unusual sex-ratio is characteristic of a particular individual. Instances, not a few, are known in which a male of some monocotus species has produced in different matings none but female, or none but male offspring. But the monocotus female, producing usually but one young at a time, is not a suitable material with which to test this hypothesis. An appeal must be made to the polycotus rodent. King (6) has found that in the case of the albino rat it was possible, starting with two pairs of rats from the same litter, to found two strains, one of which produced a high proportion of males, the other a preponderance of females. The progeny of one pair — pair *A* — were bred brother to sister without selection for six generations in order to build up a homozygous and uniform race. After this selection was practised, the brothers and sisters being chosen from litters which showed a preponderance of males. In line *B* the selection after the sixth generation

was made from litters showing a preponderance of females. After fifteen generations of such inbreeding and selection, the sex-ratio at birth in line *A* was 125 : 100, in line *B* 83 : 100. The habitual production of an unusual sex-ratio can be the expression of a genetic constitution. It is possible to breed for a preponderance of one sex.

The sex-ratio varies with the seasons of the year. It is not improbable that the breeding season is one in which the general physiological condition of the individual is above the average, and it is of interest therefore to compare the secondary sex-ratio following conception during the breeding season with that following conception at other times.

The human birth-rate actually shows a slight variation in spite of the fact that nearly all traces of the primitive breeding season have been obliterated by social habits. It is found that the sex-ratio is low for births resulting from conceptions at the seasons of greatest fecundity and high at the times of lowest birth-rate.

Dighton (7) gives the following figures for the greyhound :

Month	Number of puppies	Dogs	Bitches	Ratio
January	726	382	344	111 : 100
February . . .	593	318	275	112 : 100
March	906	468	438	106 : 100
April	794	408	386	105 : 100
May	1129	587	542	108 : 100
June	892	486	406	110 : 100
July	932	480	452	106 : 100
August	669	354	315	112 : 100
September . . .	314	173	141	122 : 100
October	250	122	128	95.3 : 100
November . . .	209	107	102	104 : 100
December . . .	122	57	65	87.6 : 100

Heape (8) and Wilckens (9) supply the following :

	Numbers	Sex-ratio, whole year	Warm months	Cold months
Horse	16091	97.9 : 100	96.6	97.3
Cattle	4900	107.3 : 100	114.1	103.0
Sheep	6751	97.4 : 100	102.1	94.0
Pig	2357	111.8 : 100	115.0	109.3
Dog	17838	118.5 : 100	126.3	122.1

PARKES (10) gives the following figures for the albino mouse :

Month	Numbers	Males	Females	Ratio	Percentage of males
March . .	25	12	13	: 100	
April . . .	82	42	40	105.0 : 100	49.7 ± 1.78
May . . .	90	44	46	95.7 : 100	
June . . .	157	78	79	98.8 : 100	
July . . .	163	88	75	177.4 : 100	
August . .	231	138	93	148.5 : 100	
September.	187	100	87	115.0 : 100	
October .	96	56	40	140.0 : 100	56.5 ± 1.27
	1031	558	473	118.0	54.2 ± 1.04

KING's (6) figures for the rat also support the contention that the season of the highest birth-rate is that of the lowest proportion of males.

The sex-ratio varies in different matings and the disturbance seems to be related to the relative physiological condition of the parents at the time. In the experience of many poultry breeders, the first lot of eggs laid by a pullet yields a preponderance of male chickens, whereas as the season advances and the pullet ages, the proportion of males steadily decreases. JULL (11) using a sex-linked cross in order to preclude errors, recorded the sex of the chickens hatched from the eggs of 45 hens during their year of production. The observation were repeated for 3 years and the sex-ratio was found to be 48.41 : 100. Analysis of the figures gave the following table :

Eggs	Sex-ratio
0 = 20	62.91 ± 1.44
21 = 40	57.46
41 = 60	45.00
61 = 80	44.61
18 = 100	37.65
100 = 120	32.53 ± 1.15

Statistical evidence has been presented, sometimes supporting, at other times contradicting the theory that the sex-ratio is affected by the relative ages of the parents, the offspring being mostly of the same

sex as the older (or as the younger) parent. HOFACKER (12) and SADLER'S (13) law that the sex of the offspring was that of the older parent, finds no support in the results of critical enquiry ; it is contradicted by the work of SCHULTZE (14) on mice, for example. According to some data, the age of the mother has a relation to the sex of the offspring, younger mothers producing a preponderance of males (or of females). It must not be forgotten that in the majority of cases the data upon which these theories are based have not been collected by biometrical experts, nor can their genuineness be absolutely guaranteed. Other data seem to suggest that the sex of the offspring tends to be that of the more (or of the less) vigorous parent, for example, the theory of STARKWEATHER (15) suggested that the " superior " parent tended to beget offspring of the opposite sex. But since it is impossible as yet to define " vigour " and " superiority " in accurate physiological terms, such theories are not suitable for scientific discussion. There is no experimental basis for such conceptions.

It has been suggested that the sex-ratio varies with the time of service during the oestrous period. PEARL and PARSHLEY (16), in testing this theory first propounded by THURY (17) and later by DUSING (18) collected data from stock-breeders and found that out of a total of 480 calves, 255 were males and 225 females, and that the sex-ratio among calves resulting from service early in the heat was 98.4 ; among calves resulting from service during the middle period of the heat was 115.5, and in thé case of service late in the heat 154.8. Later data collected by PEARL (19) did not support the suggestion that service early in heat resulted in a female calf, late in heat in a male.

The suggestion that there is a relation between the sex-ratio and the size of the litter in polycotus animals is not supported by the re-results of WENTWORTH (20) working on dogs and pigs, of NING (21) working on rats, of PARKER and BULLARD (22) and of MACHEN (23) and also of PARKES (24) working on pigs.

It would seem that the sex-ratio varies with the parity with the chronological number of the pregnancy, for in the case of the human, the dog, and the mouse, it has many times been noted that there is a continuous drop in the sex-ratio at each succeeding pregnancy (WILKINS (9), PUNNET (25) BIDDER (26), COPEMAN and PARSON (27). KING (28) found that the same rule obtained in the case of the rat :—

Sequence of No. litters	of litters in the series	Individuals	Males	Females	Sex-ratio
1	21	131	72	59	122.0
2	21	162	85	77	110.4
3	18	127	64	63	101.6
4	15	26	41	55	103.1

PARKES (10), working with mice, gives the following table:

	Total	Males	Females	Sex-ratio
First births .	242	134	108	$124.2 = 55.4 \pm 2.14$
Subsequent births . . .	190	114	76	$150.0 = 60.0 \pm 1.60$
	432	248	184	$134.9 = 57.3 \pm 1.60$

PARKES points out however that most of the second and higher births occurred at the end of the breeding season when the sex-ratio is at the highest and that his figures should not be weighted with too much interpretation until the experiment has been repeated.

It has been suggested that the sex-ratio varies with the time relation of successive conceptions. RUMLEY DAWSON (29), for instance maintained that in the case of the monocotus female the right ovary elaborated only male-producing ova, the left only female-producing, and that the ovaries function alternatively, ovulation occurring in one ovary at one oestrous period, in the other at the next. Knowing then the sex of the first offspring of the female, and keeping a record of all oestrous periods, including those suppressed by the first pregnancy, it is possible, according to this theory, to arrange services so that subsequent offspring produced by this female shall be of the selected sex and likewise to foretell their sex. In order that an offspring of the same sex as the first shall be produced, all that is necessary is to see that conception should coincide with an oestrous period which when referred back to the one associated with the conception of the first offspring is an odd number, 9th, 11th, 15th and so on. If progeny of the opposite sex are desired, then conception must be made to coincide with oestrous periods with even numbers, 10th, 12th and so on.

It should be stated that a considerable number of experienced stock-breeders in this and in other countries claim that their observations entirely support this theory. Nevertheless it cannot be brought into harmony with established scientific facts and therefore it cannot be accepted on its present day evidence. The theory is supported by a collection of selected statistical data applied without proper statistical treatment and those cases which do not fit into the scheme are airily dismissed, whilst the great body of established facts which supports other theories and which cannot support this particular one is neglected. The matter has been tested experimentally and found wanting. DONCASTER and MARSHALL (20) have shown that unilateral ovariotomy in the rat does not result in the production of offspring of one sex only and the cogency of these experimental results cannot be dismissed by any such statement as that it is too far a cry from the rat to the human female. If the breeder really desires to have this theory tested the way is simple, for it can readily be shown that unilateral ovariotomy in the pig or in the cow is not followed by the production of offspring of one sex only and that the production of both male and female progeny is not to be explained by any regeneration of the imperfectly removed ovary. As it is, the believer in this theory may well be content, for a calf must be either a male or a female, some matings undoubtedly produce a preponderance of female calves, and in any case if a calf of the wrong sex appears the breeder can always find some satisfying explanation for the unexpected.

In the case of the rabbit it has been shown that the sex-ratio is related to the chronological order of the service of the buck, in the first service group there is a preponderance of males and then an increasing preponderance of females as the number of services increases. HAYS (31) obtained the following results.

Service:	1st	5th	10th	15th	20th
Sex-ratio:	56.33	43.50	44.44	54.65	21.87

The sex-ratio is profoundly disturbed as a result of interspecific and intervarietal crosses.

HALDANE (32) has pointed out that in any such cross the sex that is absent, rare, or sterile, is the heterogametic sex.

Insects. (In Lepidoptera the female is heterogametic in Drosophila the male).

Mother	*Father*	*Males*	*Females*	*Author*
Nyssia graecaris.	*Lycia hirtaria.*	65	0	HARRISON (33)
,, *zonaria.*	,, ,,	208	0	,,
,, ,,	*Poecilopsis isabellae.*	32	0	,,
,, ,,	,, *pomonaria.*	90	0	,,
,, ,,	,, ,, (*inbred*)	71	5	,,
,, ,,	,, *lapponaria.*	93	0	,,
,, ,,	,, ,, (*inbred*)	62	3	,,
Lycia hirtaris.	,, *pomonaria.*	86	75	,,
,, ,,	,,	190	14	,,
Poecilopsis isabellae.	*Lycia hirtaria*	38	32	,,
,, *lapponaria.*	*Poecilopsis pomonaria.*	38	39	,,
Oporabia dilutata.	*Oporabia autumnata.*	6	0	,,
Tephrosia bistortata.	*Tephrosia crepuscolaria.*	378	122	,,
Drosophila melanogaster. (fused)	*Drosophila melanogaster.* (normal)	0	823	LYNCH (34)
,, (fused XXV)	,, ,, ,,	9	744	,,
,, (rudimentary)	,, ,, ,,	10	923	LYNCH & BRIDGE (33)
,, (rudimentary XXV)	,, ,, ,,	92	647	LYNCH (36)
,, *melanogaster.*	,, ,, *simulans.*	2	3552	STURTEVANT (37)

Birds (female heterogametic).

Turtur orientalis.	*Columbia livia.*	13	1	WHITEMAN AND
Streptopelia risoria.	,, ,,	38	0	RIDDLE (38)
,, *alba risoria.*	,, ,,	11	0	,,
,, ,, *risoria.*	*Zenaidura carolinensis.*	16	0	,,
Gallus domesticus.	*Phasianus colchicus.*	100	1 ?	LEWIS JONES (39)
Phasianus reevesii.	,, *torquatus.*	161	6	SMITH & HAIG
Phasianus reevesii.	*Phasianus versicolor.*			THOMAS (40)
Tetrao urogallus.	*Tetro tetrix.*	40	8	SUCHETET (41)
Gatlus domesticus.	*Pavo nigripennis.*	2	0	TROUESSART (42)

Mammals (male heterogametic).

Bos taurus.	*Bison americanus.*	6	49	BOYD (43)
,, *taurus.*	,, *bonasus.*	1	3	IVANIV (44)

GENETIC CAUSES OF A DISTURBED SEX-RATIO.

In the case of the mammal, in which group the male is the heterogametic sex, there are two kinds of spermatozoa, the X-chromosome bearing and the Y-chromosome bearing, WODSEDALEK (45), ZELENY and FAUST (46), as a result of measuring the length of the sperm head, have brought forward evidence to show that there are two intergrading classes of sperms, one class being of larger size than the other. It is assumed that in those cases in which this size difference can be detected, as in the horse and the boar, the larger class contains the X-bearing sperm, i. e. the female producing, and the smaller size class the Y-bearing sperm, the male-producing, since from what is

known of the difference in gene-content of the X and the Y in *Drosophila* it is assumed that the Y-chromosome possibly contains less chromatin material than does the X.

The primary sex-ratio is affected by the differential production of the two sorts of gametes by the heterogametic. That such differential production exists there can be no doubt, though the cause for this is not well understood. It can be produced experimentally as is shown by the work of SEILER (47) on the Psychid (*Talaeporia tubulosa*) in which the female is the heterogametic sex. SEILER was able to show that the ratio of the eggs in which the X-chromosome passed into the polar body to those in which it remained, was exactly the same as the sex-ratio. Moreover, since in the course of these observations it was possible to detect the moment of the disjunction of the X-chromosome, it became possible to attempt to influence this disjunction experimentally and so to disturb the sex-ratio. SEILER by varying the temperature during the antimaturation division obtained the following significant results :

Temperature	X-chromosome remained in the egg.	X-chromosome passed into the polar body.	Sex-ratio
18° C.	61	45	136 : 100
35-37° C.	52	84	62 : 100
3.5° C.	48	31	155 : 100

RIDDLE (48) submits that it is possible to distinguish between the two sorts of eggs in the pigeon. According to this authority, in pure species of pigeons the first egg laid, smaller and containing less chemical energy than the second, is destined when fertilised to become a male, the second a female. CUÉNOT (49) and COLE (50) however disagree with this conclusion. HEAPE (51) kept two aviaries of canaries under very different conditions and found that the sex-ratio in the two cases was markedly different. One aviary was well lighted, the temperature equable and the birds did not receive specially rich food ; the other was darker, the temperature varied, and the food was abundant and rich. The percentage of males produced by the first aviary was more than three times that obtained from the second, in which the environmental conditions were not so favourable. Since the birds were interchanged without the sex-ratio being altered, it was concluded that the difference in the ratios was due to a selective action upon the production and survival of the two sorts of gametes of the heterogametic sex, in this case the female.

The sex-ratio is affected by the relative degree of maturity of the ovum at the time of fertilisation in those cases in which the female is the homogametic sex. It is possible experimentally to modify profoundly the sex-ratio, as is seen in the case of the frogs of HERTWIG (52) and of KUSHAKEVITCH (53), or of the trout of MRSIC (54), and this may be explained on the assumption that the over-ripeness of the ovum is associated with extrusion of the X-chromosome into the polar body, thus leading to the production of males. HERTWIG allowed a male frog to fertilise half the eggs of a female and removed him from the nuptial embrace. The female does not lay her eggs in the absence of the male and so after an interval of any duration, the male can be put back and will then fertilise the remaining eggs. The sex-ratio of the frogs hatched from the first half of the eggs was in every case near equality ; with the rest the degree of disturbance of the sex-ratio varied with the length of the interval. KUSHAKEVITCH, HERTWIG'S pupil, repeated and confirmed these results.

Hours	0	6	18	24	36	42	54	64	89
Hertwig	58	54		55					
	49				58		59		
	48.5		37			58		88	
Kushakevitch	55								100

The quantitative difference that exists between the X and the Y chromosome-bearing spermatozoa in many mammals, for example in the mouse, rat, pig, bull, horse, and man, may possibly supply an explanation of the differential production of the two sorts of gametes by the heterogametic sex ; but it is likely that a disturbed primary sex-ratio is more commonly the result of a differential activity, susceptibility or mortality, on the part of the two sorts of sperm. In the case of the heterogametic female, environic conditions, as is seen from SEILER'S work, can cause a differential production of the two sorts of eggs, resulting from a differential maturation division. Conditions may be such as to induce, for example in the case of the first egg of the pigeon, the female-producing genetic complex (= the Y) to be extruded into the polar body more often than the male-producing genetic complex (= the X), whilst as a result of further egg-laying the conditions become such that the male-producing genetic complex is more frequently extruded. There is evidence which seems to show that there is a differential chemical constitution in

the early egg and the later, and it seems probable that this difference is mirrored in the different reaction systems in the dividing cocytes. RIDDLE has found that by forcing the female bird to lay eggs at more than the normal rate, the proportion of females among the progeny is increased; PEARL's (55) work yielded suggestions that this also might be the case in the fowl, for significantly more females were produced by hens which had laid very heavily immediately prior to mating. The matter needs further investigation. It is well to bear in mind, therefore, the possibility that the differential production of gametes may be characteristic of a particular individual or strain, the result of some heritable mutation affecting the maturation division of the egg, or leading to the suppression of one sort of sperm. This probably lies at the basis of such results as those of KING in her inbreeding experiments with rats in which she was able to shift the sex-ratio in either direction.

Disturbed primary sex-ratio may be the result of a differential mobility and vitality of the X and Y-spermatozoa, or of a differential attraction for sperm by the X and the Y-eggs of a heterogametic female. Such a conception as this postulates that there is a competition among the sperm; COLE and DAVIES (56) have shown that this is the case. A rabbit was served by 2 very different bucks in rapid succession. In the litter which resulted the majority claimed one of the 2 bucks as their sire. In repeated matings this was always so. But when the sperm of the buck were alcoholised they could not compete with those of the other buck, though it was shown that when employed alone they could and did fertilise ova. It is reasonable to assume that if differences in the size of the sperm are associated with differences in motility, activity, or resistance to unfavourable conditions within the genital passages of the female, chance would favour fertilisation by one rather than by the other kind of sperm. There can be no doubt that an unusual sex-ratio may be but the reflection of a disturbed primary ratio, or, on the other hand, it may be the measure of a selective prenatal death-rate to a differential elimination of one sex, or, again, it may be the sum of these two.

The sex-ratio may be profoundly disturbed by the selective elimination of the zygote, e. g. a differential mortality of the males or females in their embryonic or foetal stages. Prenatal mortality due to the action of an unbalanced sex-linked lethal factor falls upon the heterogametic sex. When more than one-sex linked lethal are present in the genotype, the sex-ratio will depend on the linkage value

between them. For example, in *Drosophila*, lethal 1 is located at 0.7, lethal 3 at 26.5 on the X-chromosome, and therefore about 25 % of crossing over will occur. The female with each of these lethals in the simplex state will have the constitution $((I_1L_3X)\ (L_1I_3X)$ and will elaborate 4 sorts of eggs in the following proportions:

(L_1L_3X)	(L_1I_3X)	(L_1L_3X)	(I_1I_3X)
3	3	1	1

and when these are exposed to fertilisation by the sperms elaborated by a wild-type male (L_1L_3X) Y the following zygotes will result:

$(I_1L_3X)\ (L_1L_3X)$	$(L_1I_3X)\ (L_1I_3X)$	$(L_1L_3X)\ (L_1L_3X)$	$(I_1I_3X)\ (L_1L_3X)$
3	3	1	1

(I_1L_3X) Y	(L_1I_3X) Y	(L_1L_3X) Y	(I_1I_3X) Y
3	3	1	1
(die)	(die)	(ewes)	(dies)

so that only one male in every eight would live and a sex-ration of 12.5 : 100 would result. In the case of *Drosophila melanogaster* it has been shown also that primary and secondary non-disjunction lead to a profoundly unusual sex-ratio and in these cases there is some definite abnormality in the chromatin content and in the genotype of the individuals that succumb. The specific action of a lethal is not be demonstrated if that action is exerted during the earliest stages of embryonic development; it has been assumed that the physiological derangement or the anatomical abnormality was such that, becoming expressed in the earliest stages of development it rendered the zygote incapable of pursuing the further developmental stages. PARKES (57) has shown that prenatal mortality in mice falls preponderatingly upon the male while in the case of the bison × cattle cross it has been shown that the lethal effect is such as to lead to severe dystocia preventing the birth of the male calf. The abnormal sex-ratio following the interspecific crosses may be due to some such cause as the action of a sex-linked lethal complex. LITTLE (58) has found that in the case of the mouse there is a factor intimately associated with that for white coat colour, which when present in the duplex condition behaves as a lethal. JONES (59) has recorded what seems to be a similar case in the cat. He had noted that the primary sex-ratio

in cats was distincly higher than the secondary, and had interpreted the difference as evidence of selective degeneration in a proportion of the foetuses. He then noted that the number of degenerating foetuses in the case of the white female was greater than that in the non-white and suggests that in some white female cats a lethal action of some sort is operative when the factor for white is present even in the simplex condition.

Selective mortality of the developing zygotes may be based upon a differential susceptibility to disease. FEZERLEY (60), for example, obtained in two successive generations of *Pygarea pigra*, the chocolate tip moth, none but females and found that the lack of males was due to an inherited disease which had the effect of making the blood of the male larvae abnormal, so that they were killed off in the larval stage. The females were unaffected but transmitted the disease to their male offspring. In such a case as this the action of a sex-linked lethal factor demonstrates a physiological distinction between the sexes. GOLDSCHMIDT (60) was able to show that in the case of the caterpillars of the gipsy moth attacked by Flacherie, a disease which affects the caterpillar about the time of the 5th moult, it did not affect the males as these were already in the pupal stage and thus secure from infection, but that it did affect the females causing among them a high death-rate and resulting in a profoundly disturbed sex-ratio. It is seen then that differences in the life history of the two sexes may provide an opportunity for the elimination of one.

The constant differences between the sex-ratio of different species cannot be regarded as the result of constant differences in the amount of pre-natal mortality unless it is assumed that each species is remarkable for its own lethal factor complex. The difference is more probably due to differences in the physical and physiological properties of the two sorts of gametes elaborated by the heterogametic sex. Seasonal variation of the sex-ratio in a species is to be explained similarly, the differences between the two sorts of gametes becoming more pronounced in the extra-breeding season. The relation of unusual sex-ratio and litter size is to be explained by selective pre-natal mortality.

Small litters are those which have been depleted pre-natally; large litters are those which have not and amongst which therefore there has been a conservation of the males. The influence of parity on the sex-ratio is entirely one of selective post-conceptional elimination of foetuses.

The work of BALZER (62) on the marine worm *Bonellia*, of GOLDSCHMIDT (63) on the gipsy moth, of ESSEMBERG (64) on the fish *Xiphophorous*, of WITSCHI (65) and of CREW (66) on the frog, of CHAMPY (67) on the triton, of RIDDLE (68) on the pigeon, of CREW (69) on the fowl, of TANDLER (70) and of LILLIE (71) on the bovine free-martin, has shown the way in which an unusual sex-ratio may be the reflection of an abnormal differentiation of the sex-organization of an individual leading to a complete sex-reversal. It is an established fact that an individual with the chromosome constitution of one sex, a determined male or female, as the case may be, may come to possess the functional sex-equipment and capacity of the opposite. A hen XY in genetic constitution may function as a male and mated with a hen will produce offspring the sex-ratio amongst which will be 50 : 100. If on the other hand, a female amphibian or mammal, XX in genetic constitution, functions as a male, its progeny will consist solely of females.

The problem of the control of the sex-ratio is that of controlling the differential production of gametes by the heterogametic sex, of controlling the physical and physiological dimorphism of these or of producing complete sex-reversal. The control of a differential elimination of the zygotes of one sex cannot be regarded as profitable even though it should be practicable. These conditions have been achieved by the experimental biologist and it would be rash to suppose that they have not unwittingly been attained in the herds of the practical breeder.

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SPANISH HORSES.

Doubtless owing to the ideas about Spain which are commonly held abroad (1) it is rare to find, either in periodical publications or in books published outside Spain, on the subject of stock-breeding and specially of horse-breeding, reasonably accurate information regarding the various kinds of Spanish horses and only too often such information is quite erroneous.

Spanish riding horses, which are chiefly intended for army use were most highly renowned all over Europe when light cavalry (2) was the predominant feature in warfare, but lost much of their utility when they were replaced by heavy cavalry, employing large horses covered, as were their riders, with heavy armour. Even then Spanish horses were used on account of their mettle and grace in the more important ceremonials at the Courts of Europe. For a long time Spanish horses were considered best by the greatest masters of horsemanship, among them F. ROBICHON DE LA GUARINIÉRE.

With the Italian Renaissance the big horse was introduced and finally predominated even in Spain itself, as may be readily understood from a study of the passage in the works of Alfonso GARRILLO LASSO *Caualleriza de Cordoua*. (Cordova, 1625) in which he laments the complaints made by Andalusian breeders to his predecessor in the management of the " Real Caballeria " of Cordova, the Neapolitan Giovanni Girolamo RIUTI, who in 1600 made use of large Nor-

(1) Julian JUDERÍAS, *La Leyenda negra*, 2nd Edition. Barcelona, Casa editorial Avaluce (The first edition appeared in 1914).

This interesting book is particularly suitable for all foreigners who which to have a fair and just appreciation of Spain. To appreciate the innate nobility of the Spanish people, the perusal of Borrow's book, *The Bible in Spain*, 1842 (translated into Spanish by Manuel AZANA under the title *La Biblia en España* by Borrow 1921, Colección Grenada-Madrid) is also recommended.

(2) In the XV century the Valencian noble Don Manuel DIAZ DE CATALAYUD, Señor de Andilla, described the war horse in a Valencian Code in such masterly fashion, that even now his description may fairly be taken as a model.

man, Danish, Dutch, Neapolitan and other stallions to obtain large carriage horses of the kind then used by the Roman Cardinals for their equipages, a fashion which became general at the Courts of Europe.

This fashion caused serious injury to the Spanish breed as also the adoption of the style of riding called " de la brida " (legs extended) in place of the classical Spanish style " a la gineta " (legs bent), as it was the cause of cross breeding with big halfbred horses, sheep-headed (Roman-nosed), without arab blood, of which there was and continues to be much in Spanish horses. Next followed the school of horsemanship described by the Italian Federico GRISONE in his work *Ordini di cavalcare et modi di conoscere la natura dei cavalli* (Venice, 1620). In this work, which was frequently translated into Castilian in the golden age of Spain with its abundance of treatises relating to horses, the sheep-headed (Roman-nosed) horse is prescribed for riding " a la brida ". The riding school of PIGNATELLI of Naples (from 1589 to 1610) was the most famous in Europe.

The Italian horsemanship of the XVI century was popular in the Courts of Europe, especially those of France and Spain. From the XV century, the customs of Italy, which was famous in arts, letters and science, began to become fashionable. The motto of education was that of the Salernian School, — *Mens sana in corpore sano* — , and in order to keep the body healthy and supple a great impulse was given to fencing, swimming, dancing, hunting, wrestling as well as to riding. In the XV century the celebrated Vittorino DA FELTRE at Mantua developed horsemanship together with intellectual education. The Court of Mantua was soon imitated by the Courts of Naples, Milan, Ferrara, Florence and lastly Venice.

In Naples, under the king of the House of Aragon, the teaching of horsemanship was much in vogue. King FERDINANDO the Catholic had already received a handsome present of Neapolitan horses.

Italian horsemanship reached its highest fame in the XVI century, to which belonged the celebrated masters and writers Federico GRISONE (1552), Cesare FIASCHI (1556), Giovanni Battista FERRARO (1560), Claudio CORTE (1562), Pasquale CARACCIOLO (1566), DE PAVARI (1581); Antonio CITO (1590); Ottavio SILICEO (1598); Giovanni Battista PIGNATELLI (1598), after whom came in the XVII century Antonio FERRARO (1602) son of Giovanni Battista, Giovanni DE GAMBOA (1606), Alessandro MASSARI MALATESTA (1607), Lorenzino PALMIERI (1625), Giovanni RONDINELLI (1633), Giovanni Battista DI GALIBERTO (1650), Ignazio CARCANI or CARCANO (1696).

Grisone, Fiaschi and his papil Pignatelli enjoyed great fame in Spain. Grisone's works were translated into Spanish and had much influence among the Spanish nobility. Many French and Spanish gentlemen went to learn riding from the masters and the Italian school of horsemanship and preference for sheep-headed horses then in vogue at the Courts of Rome and Naples became fashionable both in France and in Spain.

To the above-mentioned Italian movement corresponds that of Spain in which figured, among others, Don Pedro Fernandez de Andrade (1580), Don Juan Suarez de Peralta (1580), Don Eugenio Manzanas (1583), Don Juan Arias Davila Portocarrero (1590), Don Pedro Aguilar, (1600) Don Diego De Cordoba (1602), Don Simon De Villalobos (1605), Don Luis Banuelos y de la Cerda (1605), Don Bernardo de Vergas Machuca (1600-1621), Don Francisco Cespedes y Velasco (1624), Don Alonso Carrillo Lasso (1625), Dávilla Heredia (1674), Don Antonio Galvan de Andrade (1678), Don Gregorio De Zuñiga y Arista (1705), Don Manuel Guerra (1701-1717), Don José De Arcos (1757), Don Francisco Vallesteros y Lezcano (1762), Don Bruno Joseph De Morla Malgerejo.

The Valencian noble, Señor de Andilla, Don Manuel Diaz de Calatayud, was perhaps the most famous of the group. In the Code written in Valencian (" Libro de Menescalia ") in the xvi century he gave such a masterly description of the cavalry horse that even to this day it might be subscribed to by the best authorities. Señor De Andilla's book was translated into Catalanian by Señor Rosell y Vilá in his *Importancia de la Ganadería, en Cataluña y estudio zootécnico de algunas de sus comarcas* (1) and some of his other writings. The genuinely Spanish bibliography of works dealing with the horse and horsemanship, veterinary science, horse breeding etc. is abundant and noteworthy, the works relating specially to horsemanship, in which Spanish cavaliers were so distinguished in the past, are however much more numerous (2).

(1) M. Rosell y Vilá, Importancia de la ganadería en Cataluña y estudio zootécnico de algunas de sus comarcas. *Memorias de la Real Academia de Ciencias de Barcelona*, 1919.

(2) See the voluminous bibliography contained in the following books :— *Caualleria de Cordoua* de Alonso Carrillo Lasso, Cordova 1625 and especially the second edition of this book which was produced at the expense of the Marquis of Jerez de los Caballeros, which is an exact reproduction of the first edition and of which 51 copies were printed. This second edition contains a preface and *Apuntes bibliográficos sobre equitación* written by Don Jose M. Nogués.

For some time past, and more particularly from the middle of the XIX century to the present day, the literature of all kinds dealing with the theme of the past and present of Spanish horses and their breeding is very scanty. An exception is the work of D. Ulderico Prado P. *El Caballo Chileno* (1). Although the modern genuinely Spanish bibliography on the subject of horse-breeding has not been very voluminous during the XIX and present centuries there is still a certain amount of material which is worth consideration, describing the qualities, chiefly vigour and great hardiness, of the various types of present day Spanish horses (2), which were so thoroughly proved during the War.

Spanish horse-breeding is particularly worth study. This from the earliest times included horses of great qualities, from Galicia to Navarre, from Andalusia to Catalonia. These horses are more or less closely related to the primitive Libyan horses, from which the best horses in the world are derived, including arabs, as is constantly

Diccionario hípico y del Sport por Federico Huesca, 2ª ed. Madrid, Librería de Fernando Fé, 1885 (Bibliography from page 673 to 680).

Marqués De la Torrecilla, *Libros, escritos o tratados de equitación, jineta, brida, albeitería, etc. Indice de bibliografía hípica española y portuguesa catalogada alfabéticamente por orden de títulos de las obras*. Madrid, 1916 to 1921. Establecimiento tipográfico de Sucesores de Rivadeneira (S. A.).

(1) Ulderico Prado P. *El Caballo Chileno*. 1541 *to* 1914. Estudio Zootécnico e histórico hípico. Imprenta de Santiago de Chile, 1914.

(2) Miguel Arroyo Crespo, *Aptitudes del caballo español para la guerra*. Imprenta del Diario de Avisos, Alfonso XII, No. 26. Cordova, April 1905.

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Julio Vicentis. *Principios de Zootecnia General aplicados a la cría caballar*. Bally Bailliere e Hijos. Madrid, 1916.

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Pascual Luna Lopez y Tomás Rota Minondo, *La Ganadería caballar en Navarra*. Asociación general de Ganaderos del Reino, 1917.

Andres Benito Garcia, *La producción del Caballo de tiro ligero en Cataluña*, 1918. Asociación general de Ganaderos del Reino, Huertas 30, Madrid.

Memorias de los concursos de ganados organizados y subvencionados por la Asociación general de Ganaderos del Reino, con la cooperación del Ministerio de la Guerra. Years 1916, 1917, 1918, 1919, 1920 e 1921.

Memoria del Concurso Nacional de Ganados de 1913. Asociación General de Ganaderos del Reino. Huertas 30, Madrid.

Memoria del Concurso Nacional de Ganados, avicultura, maquinaria e industrias derivadas organizado por la Asociación General de Ganaderos del Reino y celebrado en Madrid en Mayo de 1922. Madrid, 1923.

General D. Juan Cotarelo y Larastazu, *Cría caballar en España y noticias históricas descriptivas acerca de este ramo de la riqueza*. Madrid, 1861.

becoming more clearly recognized. A careful study of ancient documents, ancient art (commencing with prehistoric rock drawings), sculptured monuments and coins gives abundant proofs of this fact (1).

It would be difficult to find in other countries such good natural conditions for the production of cavalry horses as in Spain. Andalusia, where horse-breeding is very ancient and goes back to early Iberian times, is not the only region in Spain which is specially well adapted for the production of cavalry horses. It has been repeatedly proved that Estramadura, some parts of Castille, including a good portion of Old Castille and Galicia, where the small ugly horses which the Swabians brought with them in their invasions took refuge, are also suitable for the purpose. Galicia and Asturia are famous for the production of small horses which have had a high reputation from the earliest times; in many districts in the northern parts of the Iberian Peninsula the effects of repeated infusion of Andalusian blood, more or less rich in Libyan and Arab blood, which is diffused all over Spain, have been for some time and still continue to be felt.

The writer's friend, Don José Maria IBARRA y FÓLGADO, Doctor of Philosophy and Letters, and Keeper of the Archives of the University Library of Valencia, to whom his ideas and researches regarding the present stock of horses in Spain have been explained, wrote the following note (2) some time ago with all the authority of his profound knowledge of Spanish and universal history: — "Phoenician and Greek colonisation could not have introduced into Spain a sufficient number of horses to cause marked changes in the stock of horses, already very abundant in prehistoric times."

"The Carthaginians by introducing *Numidian* horses influenced the southern and eastern regions, probably renewing the pre-existing Barbary or similar blood."

"The Romans, who at all ages supplied their legions with Numidian horses, continued and developed the initial introduction by the Carthaginians; they also probably brought into Spain with their troops a small number of horses of various breeds."

(1) William RIDGEWAY, *The Origin and Influence of the Thoroughbred Horse*. Cambridge University Press, 1905.

(2) It was quoted, for the first time, at pages 30-32 of the book. *A propósito de los caballos españoles con cuernos. Resumen de algunos estudios de Rafael Janini-Janini*. Valencia, 1919, Imprenta Hijos de Francisco Vixes Mora. Calle de Hernán Cortés, 8.

" The Barbarians, who had considerable political influence in our country, the Goths (Visigoths and Ostrogoths combined) could have introduced very few of their own horses. Their long migration of three centuries from Scandinavia to Spain passing through Central Europe, the Black Sea Coast, the Balkans, Asia Minor, the East coast of the Adriatic, Italy and Gaul, a period of almost continual combat, makes it exceedingly improbable that they brought their own stock of horses into the Iberian peninsula."

" The influence of the Vandals was probably stronger during the few years that they remained in Spain in their transit from beyond the Rhine to the western half of North Africa. That of the *Alanos* could not have been great."

" The influence of the Swabians may, with good reason, be regarded as important. In less than 5 years (404 to 409) they passed from their original home to the Iberian peninsula, a few only of their groups finding their way to Italy with the poly-barbarian army of Radagaiso, very few of whom were able to re-join the principal body. Establishing themselves firmly in the North West, although for a few years they dominated almost the whole of Spain, they must also have established their war horses and the horses which drew their wagons. These wagons transported from modern Swabia as far as Galicia (the most remote region of Spain and owing to its extreme position the least harassed by war) the entire Swabian village, women, children, old people and the few domestic utensils appropriate to the degree of civilisation in which they lived."

" Owing to the relative brevity of the Swabian invasion, or rather migration, it is reasonable to suppose that the majority of the riding or draught horses which crossed the Rhine died in the region of Miño, where they must have met with the remains of the primitive Spanish horses, already in existence before the various invasions by barbs and little influenced by them, that is to say, with horses more purely Spanish and kept in a district into which fewer foreign horses had been introduced."

" The Mahometan invasion, so far as horses were concerned, introduced practically nothing of the Arab element and was almost entirely composed of barbs. Of the same origin were the Almoravidi, the Almohadi and the Benimerini which re-invigorated the Mussulman dominion. The regions which felt their influence were, in decreasing order, South, East, Centre, Ebro Valley, Pirenaica and Galicia. It may be that along the natural lines of communica-

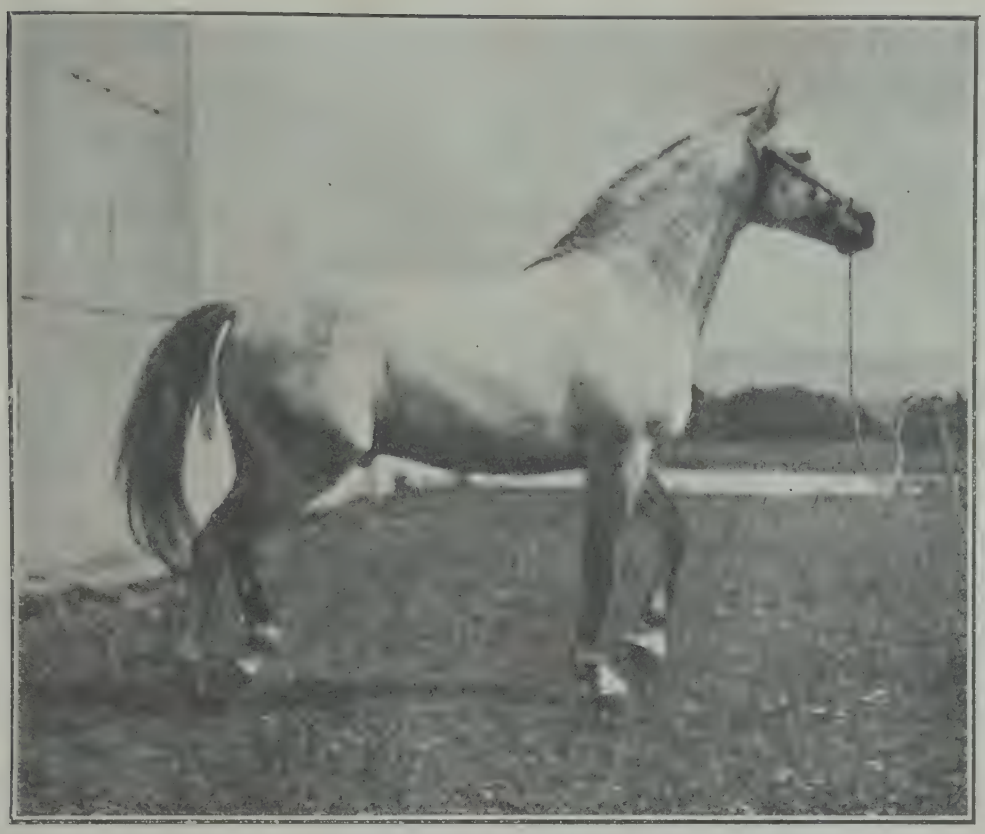

FIG. 64. — Half-blood Spanish-Arab Stallion, belonging to Don Francisco Guerrero of Jerez de La Frontera.

FIG. 65. — Pure-bred Spanish horse belonging to Don Enrique Granda y Calderón, of Robles de Trujillo (Badajoz).

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FIG. 66. — Dinamita II, half-blood Anglo-Spanish mare, belonging to the stable of Duke Viudo de Bailén, in the province of Toledo.

FIG. 67. — Half-blood Spanish-Arab colt, belonging to the stable of Don Francisco Guerrero, of Jerez de La Frontera.

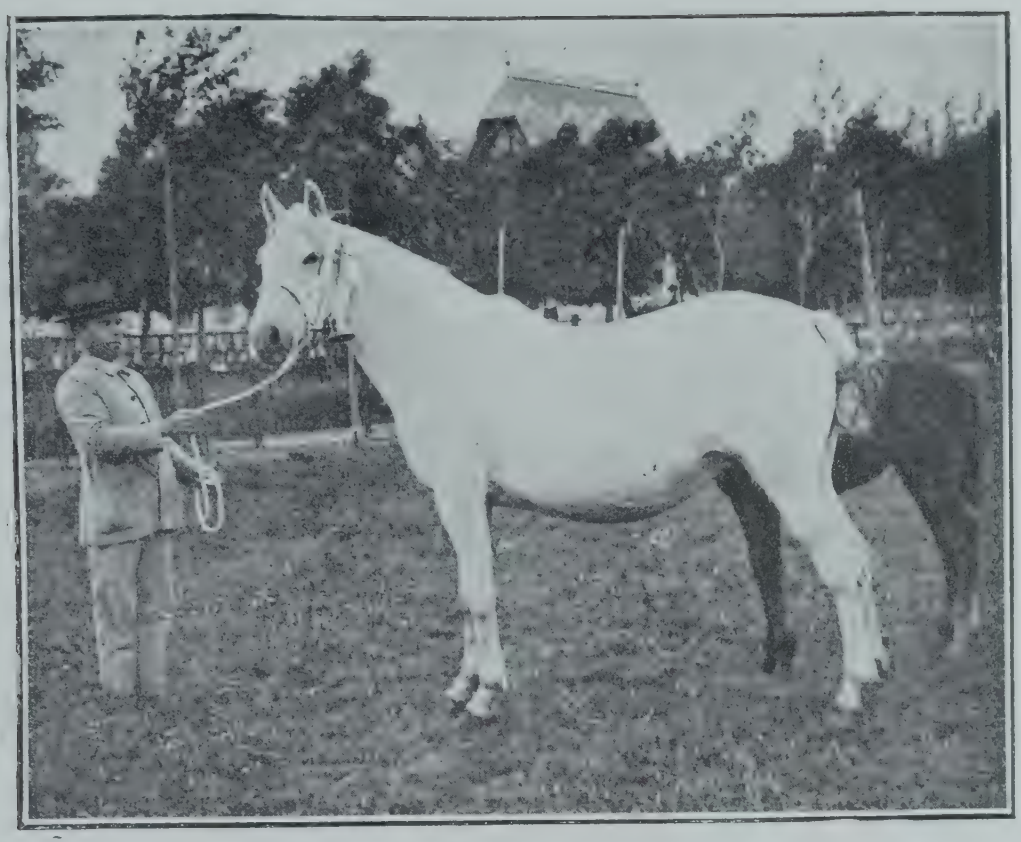

FIG. 68. — Preciosa, pure-bred Spanish mare, belonging to the heirs of Marquis de Casa-Domecq, of Jerez de La Frontera.

FIG. 69. — Alfanje, pure-blood Arab four-year old, bred at the military stud for pure Arabs at Jerez de La Frontera.

FIG. 70. — Federal, pure blood dark-chestnut, seven-year old Spanish stallion, belonging to the stable of Don Gregorio García, of Cordova.

FIG. 71. — Group of three-year old fillies, belonging to Don Mariano Medina at his estate at Villarubia, province of Cordova.

tion across Pirenaica (Ampurdan, Navarre, Upper Aragon) there remain some larger traces due to the trade in horses during the Middle ages and to the expedition of Sancho VII of Navarre in the service of the Emperor Almohade in the years preceeding the campaign of Navas of Tolosa."

"It should also not be forgotten that pilgrimages to Santiago de Compostella, a medieval religious centre comparable only with Rome and Jerusalem, and the participation of French knights (especially Burgundian) and a number of Normans, Germans, English and Italians in the crusade of reconquest are factors which may have influenced, though not largely, the stock of horses."

As examples of present day breeding stations for riding and carriage horses in Spain may be mentioned those of the following: Guerrero Hermanos, Francísco Guerrero Hijos de Perea, Marqués de Casa-Domecq, all of Jerez de La Frontera — D. Enrique Granda y Calderón Robles de Trujillo, Duca de Bailén and Duca de Veragua in the Province of Toledo — D. Florentino Sotomayor of Cordova D. José Vazquez Rodríguez, Camíno Hermanos, Candau, D. Miguel, Rioboo, Anselmo R. de Rivas, Herederos de Miura, D. Felipe Pablo Romero, all of Seville — D. Gregorio García y García, D. Casado López, both of Cordova — together with many others.

Particularly worthy of notice is the stud of pure bred Arabs at Jerez de La Frontera founded by General Jaquetot which, thanks to the intelligent and enthusiastic management of Cavalry Lieut. Colonel D. Ricardo García Benitez, produces the purest strain of Arab horse. From the earliest to most recent times the results of cross-breeding between the Arab and Spanish horse have been very satisfactory. Not only do Arab horses cross well with Andalusians but even in Asturia very fine horses of half Arab breed may be seen. Persons acquainted with Spanish horse-breeding are well aware that in view of the results obtained there is a tendency to simplify the employment of stallions, which is being limited to Bretons and Percherons for heavy draught horses for purposes of agriculture and artillery and to the Arab and English Thoroughbred for riding horses.

The stud of Hospitalet de Llobregat (Province of Barcelona) which belongs to the Artillery, has produced for some years draught horses for agricultural and artillery use. The results obtained from this Stud in Catalonia and the influence of farmers and breeders supported by the "Asociación General de Ganaderos del Reino"

have caused the " Dirección del Fomento de la Cría Caballare " which is under the direction of the Minister for War, to use, for ordinary purposes, medium sized Percheron and Breton stallions and have proved that really fine pure bred horses of these breeds and half bred Spanish-Percherons and Spanish-Bretons are to be found in Spain.

As there is no lack of good mares and stallions, the army has provided military stud Stations (" yeguadas ") at which this policy is now being followed. The first was established in the " dehesa " (pasture) of Moratella and assigned to the second remount establishment (Cordova). It was started with horses of various breeds, among which the English Thoroughbred and the Spanish predominated ; later Arabs, Anglo-Arabs, Percherons, Bretons etc. were very wisely and properly added to the stud. In course of time this Station took the name of " Yeguada militar " and was made independent to the great benefit of Spanish horse-breeding. Following on this, and preparatory to the division of Spain into breeding zones, three Stations were established : — one in Léon, for Percherons, with the same staff as the Stallion Depot of that town ; another at Trujillo for Orlow and Rostopchine trotters, which lasted for a short time only, the third in Jerez de la Frontera (" dehesa of Zancadilla "), for pure Arabs, which is of special importance.

There are now in Cordova some fine specimens of Spanish-Anglo-Arab and Spanish-Arab horses.

An accomplished veterinary surgeon, D. Miguel A. Villarrasa (1) has done much for the improvement of mules, so numerous in Spain, with the best product of the famous stallion asses of Vich (Province of Barcelona).

The mule is produced in Spain both in the fields and mountains of Galicia and in the mountains and valleys of Aragon and Catalonia and also in the old Kingdom of Valençia, with its complex conformation, as well as in Old and New Castille, in Estremadura and Andalusia. It should be remembered that, although there is a large coastal area, Spain has a mean altitude of 600 metres and the most irregular conformation of any country in Europe with the exception of Switzerland, which has a mean altitude of 1300 metres, since it includes the principal peaks of the Alps.

(1) In Sicily, Piedmont and Savoy Catalonian Stallion asses of Vich are imported, from which those of Castile are derived, as well as the particularly famous breed of Poitou. See on this subject D. Miguel A. Villarrasa Allmony, *El ganadillo Catalan, Asnos de la Comarca agricola llamada de Vich* (Provincia de Barcelona), January, 1911.

The always noteworthy Andalusian breed of horses which could never have been homogeneous, because it was neither North-African nor the cavalry of the Moorish and Arab invaders, has had and still has a great influence on all the varied stock of horses in the whole of Spain. Its main origin was in the Province of Cadiz and afterwards the breed spread widely all over Andalusia and thence through Estremadura, though there was a gradual falling off as it continued towards the North; its influence however remained strong up to the Pyrenees on the Spanish slope and on the other side in France.

At the same time this influence affected also the remote valleys and the highest mountains of Galicia and Asturia, regions where most of the better class horses and mares as well as the horses intended for mule breeding are of Andalusian origin. This influence traversed plains and mountains, and showed itself in the highest gulleys of the most difficult mountains in the mettle, hardiness and general superiority of the animals, qualities which in a great measure are preserved unchanged because the regions are difficult of access. The influence of the Andalusian blood is thus manifest in the semi-wild droves of Navarre, Biscay, the Asturias, as well as those of Galicia where the effect of African blood was less felt and the small, ugly, but very strong and resistant horses introduced by the Swabians remained.

The agricultural-artillery heavy draught horse has its breeding centre in Catalonia (where however, including Cerdaña, Arab and Andalusian blood made their effect noticeable up to a comparatively recent date), and this is natural in view of the historical bonds with France. This type of horse is much like that which, as has been previously noted in the writer's books, was imported into Spain in the middle of the XIV century, and for choice from Britain. This introduction had no very special results and it is natural that at the present time Catalonia, and chiefly the Provinces of Gerona and Barcelona, should be the true centre from which the breeding of the agricultural and artillery horse is diffused through Spain. Already for some years past this form of horse breeding has taken root in some valleys in the North of Spain and more particularly in the Province of León.

Spreading from Catalonia and León the Breton and Percheron horses render useful service in many zones which have irrigated crops in the east part of the Peninsula and in the valleys of its rivers, as well as, it is said, in the valleys of the north, as may be seen not

only in Catalonia and the valleys of the Ebro, in Valencia, León, Santander and Palencia, but also in the heart of the Pyrenees (Roncesvalles, Burguete, Canfranc) and even in Galicia.

In Navarre, the district in Spain which is best known for its small sized horses or ponies, crossing with small or medium sized Breton horses has, as previously stated, been practised for some time. Navarre ponies, as is to be expected, have impressed their characters on those in the neighbouring districts, for example in those of the high valleys of the Huesca Mountain, of the Hecho, Broto and Canfranc valleys, where Breton halfbreeds are also found. This influence crosses the Cantábrica mountain chain, Guipuzcoa, Biscay (with its semi-wild droves of Carranza), Santander and Oviedo and reaches, though in somewhat diminished force as far as Galicia, which, as has been said, is stocked with typical ponies and small ponies of Swabian origin, who in turn make their influence felt and impress themselves to a constantly decreasing extent until the high mountains of the Province of Santander are reached, where some centuries ago the Andalusian strain similarly left its mark.

Some consider the frequent existence of a medley of characters to be a defect in the Spanish breeds of horses. This is to a great extent logical, but the same fact is to be found in the human inhabitants who have been influenced by Greeks, Carthaginians, Romans, Swabians, Goths, Arabs, etc.

However *this influence can never cancel the national imprint, or rather the Iberian regional imprint.* Recent or comparatively recent facts prove how in Andalusia itself and mainly in Jerez de La Frontera, as well as in Malaga, in the human population typical infusions of English blood have disappeared, the descendants, both men and women, preserving the typical Andalusian character. And in the mixture of blood in the Valencians the sweet, natural beauty of the women endures always.

In the Spanish breed of horses the infusions of Norman, Dutch, German and English blood have largely disappeared and are soon replaced by the local strain.

This tendency also occurs with the Percheron and Breton, in passing from the North towards the South: after a few generations the animals tend clearly to gain in elegance of form, while the characters impressed by the Arab is very enduring, no doubt owing to the influence of environment and the strength of the race.

FIG. 72. — Light-chestnut pony of Navarre.

FIG. 73. — Small dark-chestnut poney of Navarre.

FIG. 74. — Draught horse for farm-work and artillery of Plana de Vich (province of Barcelona) parentage, a chestnut five year old, 1.55 metres high

FIG. 75. — Three-year old Ass (stallion), 1.55 metres high, belonging to the Interior pedigree book of Vich (province of Barcelona).

Spain is a country with a very fine and valuable stock of horses, which constitutes a solid advantage, from which great benefit may be derived. It should be remembered that for a horse, vigor, mettle and hardiness are more necessary than beauty of form, qualities abundant in almost all Spanish horses and not unknown in the Iberian rural breeds and those employed in the civil wars of Spain.

Exploits which equal and exceed those of Breton horses in artillery and Anglo-Arabs in cavalry work with the French Army during the Great War can be told of Spanish horses.

In drawing tramcars couples of Spanish horses have covered, in summer, some 100 kilometers daily (1) and have proved themselves no less valuable than the best " Pomponnee " and " Gazelli " (2). There are in Spain horses of such good value that of them might be said as by the poet Friarte in the Virgilian mode, *vento gravidas ex prole putabis*, which is the well-known inscription cut over the stud establishment " Real yeguada " of Aranjuèz.

The writer may also here repeat the statements made in his previous work, how much there is that is good and genuinely Spanish, worthy of many-sided study and of praise but long hidden by the mantle of the oppressive, infamous and harmful " Black legend ", which weighs on the patient and noble Spanish nation ; among these he would include all question of horse-breeding.

When the decadence of Spain began, the recent genuinely Spanish movement, which is now to be observed under many aspects in the country and grows stronger every day, had not begun. In this general movement now in progress, which brings to light ancient and genuinely Spanish virtues, is included horse-breeding all over Spain. The general trend of horse-breeding is being continually improved by an increasingly perfected *Fomento de la Cría Caballar* (a body under the control of the Minister for War) and by the activities of the " Asociación General de ganaderos del Reino " whose President is the Duke DE BAILÉN and whose Secretary is the Marquis DE LA FRONTERA, around whom are grouped other keenly interested persons throughout Spain, in the " Junta provinciales de Ganaderos " ;

(1) Pruebas y hechos de resistencia de caballos. *Memorial de Caballería del Ejército.* Nos. 42 to 45, Article by Rafael JANINI-JANINI.

(2) P. MARCHART, *Chevaux et voitures d'Artillerie.* Paris, 1913. See also Rafael JANINI-JANINI's book *Los caballos en la Gran Guerra. Enseñanzas y orientaciones*, 1918.

by the influence of the " Cuerpo de Veterinaría Militar ", by the Civil Veterinary authorities the value of whose services is constantly increasing and among whom may be specially mentioned the " Inspectores provinciales de Higiene y Sanidad pecuarias ", who have been ably assisted by the agricultural engineers. In Spain, including the Canaries and the Balearic islands there are about 722 000 horses, 1 295 000 mules, 1 138 000 donkeys and all these animals, whatever their degree of beauty, have in the highest degree the qualities of mettle, strength and hardiness.

Rafael JANINI JANINI,
Agricultural Expert to H. M. King Alfonso XIII.

CONDITIONS FOR OBTAINING FROM THE BAVARIAN COMMISSION OF TECHNOLOGY AND AGRICULTURE A CERTIFICATE OF RECOGNITION FOR AGRICULTURAL MACHINES AND IMPLEMENTS.

The extended use of machines may be regarded as giving a great impetus to agricultural production, for by means of machinery, the work of the farm can be executed quicker, better and as a rule at a cheaper rate.

Such machines and implements only as are made of the best material and answer the purpose for which they were designed, are really beneficial to the agriculturist.

It is therefore necessary to find ways and means or insuring that the output of the factory really answers the requirements of the farmer. In many cases, labour, coal and iron are utterly wasted upon the construction of machines and implements that are not needed, or have not yet advanced beyond the trial stage and are therefore not yet in a condition to be put on the market. There is nothing that arouses the agriculturist to such deep distrust of the manufacturer's novelties as the output of inferior products, which after being used for a short time, and causing annoyance and keen disappointment, have to be scrapped as old iron.

The Local Commission of Technology and Agriculture ("Landesausschuss für Technik und Landwirtschaft") is of opinion that the certified approval of the machines before they are allowed to be sold, is the only way in which the manufacturer can extend and deepen his knowledge of the aims and objects of agriculture and succeed in gaining and keeping the confidence of the farmer.

Object of the Certified Recognition of Agricultural Machines.

To provide a guarantee that these machines and implements have been proved by means of technical and agricultural tests to be

capable (under the given natural and economic conditions), of fulfilling satisfactorily the purpose for which they were constructed and are likely to continue to do so for a reasonable time.

General, Preliminary Conditions.

Although on principle, all German machines and implements are eligible for approval, it remains within the discretion of the commission to refuse to test any such machine or implement without stating the ground of its decision. As far as possible, the trials of the machines and implements are carried out in groups though in special cases single entries are permitted.

When group trials are to be held, an announcement to this effect is inserted in the "*Technik in der Landwirtschaft*", "*Die Landmaschine*", or any similar and suitable periodical.

Application for Recognition.

All applications must be sent to the "Geschäftsstelle des Bayerischen Landesausschusses für Technik und Landwirtschaft" of which the present address is Munich, Briennerstrasse 8, 4 Aufgang.

The application is to be accompanied by a statement giving the type, name and use of the machine or implement, the name and address of the applicant and of the maker, the net selling price at the factory, the weight (without the prescribed protective devices, which must however also be given) and the space occupied. In addition, the catalogue designation must also be submitted together with a short description, technical drawings and figures so as clearly to show the construction and size of the machines or implements.

The machines and implements submitted for testing must be of normal construction as represented in the catalogue and not differ in any way from the usual stock goods on the market. They should be presented unpainted, but may have a coating of light varnish.

In the case of a novelty that has never before been offered for sale (either in the present or a modified shape) this fact must be clearly stated in the description on the application form. The applicant is required to state wherein the novelty consists and must furnish a special sketch and description of the "new" parts of his apparatus.

The results of trials, public awards, patents, trade-marks etc. must be given and should be entered on the original form, or in the

duly certified copy thereof. The diagrams and figures remain in the hands of the commission until all the required formalities are concluded.

The Commission is empowered to require the applicant to furnish proofs of the accuracy of his statement, or to supplement it by further details ; it may refuse to accept any applications not accompanied by a sufficiently detailed description.

Payment of Expenses.

All the expenses of certification are defrayed by the applicant. On application, a preliminary payment of 10 % of the net sale-price of the machine or apparatus is to be made. This payment is refunded (after the deduction of the fees, etc.) if the application is withdrawn in proper time, or is refused by the Commission.

Procedure of Machine Certification.

The "Landesausschuss für Technik und Landwirtschaft" appoints a special committee to examine and pass the machines. The preliminary and concluding work is carried out at the office of the Commission.

The Committee is generally composed of the President of the "Landesausschuss für Technik und Landwirtschaft", representatives of technical and agricultural science, and representatives of the manufacturing-trade and of agriculture, both the latter being selected, if possible, from professional workers. The manager of the Weihenstephan Machine Enquiry Office (*Maschinenauskunftstelle*) and the Reporter (*Referent*) for Agriculture and crop cultivation of the Bavarian Peasants' Chamber (*Landesbauernkammer*) may sit on the Committee by virtue of their offices.

In the case of machines and implements which need to be tested in various parts of Bavaria in order to show their general efficiency (ploughs, cultivators, and harvesters as well as implements used for particular crops), special district commissions composed of experts can be appointed as occasion arises. If necessary, these members many be drawn from the District Branch of the Association of German Engineers (*Bezirksverein des Vereins Deutscher Ingenieure*) and the "Kreis- und Bezirksbauernkammer". Otherwise, the committee does not delegate its powers to any third party.

The Necessary Tests and Trials.

All the machines and implements are, as a rule, subjected to a technical preliminary test and a special agricultural test. The technical trial consists in the testing of the construction and of the material.

The construction test consists in the investigation of the structure, workmanship, efficiency and probable durability of the machines and implements.

When required, the material is tested in the mechanical Workshops of the Munich Technical Higher School (*Technische Hochschule*).

The special agricultural tests are directed to determining the quality and quantity and economic value of the work, *e. g.*, method of working, performance, easy handling, adaptability tov arious conditions, suitability for different kinds of soil and positions, draught power required, fuel and lubricants used, attendance and special training needed, simplicity and suitability of the components, capacity for transformation into another type of implement, weight, price, type of farm on which the machine or implement can be economically used, protective devices, etc.

The results of the construction and material tests will be entered on separate certificates.

If either of these certificates bears the general verdict of " Unsatisfactory ", the commission may refuse the admission of the machine or implement to the special test. Such an exclusion is tantamount to a refusal to grant the certificate.

When the preliminary and the special tests have been carried out and their results recorded, the Certifying Committee meets and gives its verdict ; the decision being expressed in the terms " certified " (*anerkannt*) or " not certified " (*nicht anerkannt*). The decision made at this meeting is communicated to the applicant in writing by registered post.

The Certifying Committee is required to communicate its decision in writing, at the close of the meeting, to the Bavarian Commission for Technology and Agriculture (" *Landesausschuss für Technik und Landwirtschaft*).

Any formal protest against the decisions of the Certifying Committee on the occasion either of the preliminary technical test, or of the agricultural test must reach the " Landesausschuss " within 10

days after the receipt of the notification. The grounds of the appeal must be set forth clearly. The protest must be accompanied by a further payment of 5 % of the net sale price of the machine, which sum will be refunded, should it be decided that the plaintiff has just cause for complaint, otherwise it is paid into the working-funds of the " Landesausschluss".

The decision is not made at once but is announced after a certain given time has elapsed.

The Certifying Committee may require the applicants, or their deputies to attend the tests.

Means of Using the Certificate of Recognition.

The awarding of the certificate is announced in the periodicals in which the notice of the meeting of the Commission was published.

Should the results of the tests be unsatisfactory, the matter is not commented upon by the Press.

The holder of a certificate acquires the right of affixing to all machines and implements that are exact copies of the specimens passed by the Commission, an exact reproduction of the badge bearing the words " recognized by the Bavarian Commission for Technology and Agriculture " 19.....

The certified approval of the Commission may only be printed on notices, advertisements and letter-heads in the complete form sanctioned by the Commission and bear the date when the certificate was granted. Single sentences, or portions of sentences may only be quoted with the express permission of the Commission.

The " Landesausschuss " reserves to itself the right of bringing before the notice of the public any especially useful machines and implements that have received its full approval.

Miscellaneous Observations.

The machines and implements to be submitted to the approval of the Commission must be collected and transported carriage-paid to the places appointed by the Commission for the tests.

The Commission assumes no responsibility for any breakage or injuries caused to the machines during their examination, mounting or operation throughout the period required for testing. The machines

are kept at the consigner's risk, though the Commission will insure all the machines and implements against fire, theft, robbery if desired, at the expense of the consigner.

The machines, etc. are returned to the sender at his own risk and expense.

The above conditions must be explicitly accepted by all applicants.

CHRISTMANN,
Ministerial Councillor and Director,
President of the Bavarian Local Commission,
Munich.

THE ORGANISATION OF INTERNATIONAL STATISTICS BASED ON THE RESULTS OF RESEARCHES CARRIED OUT WITH THE ASSISTANCE OF AGRICULTURAL BOOK-KEEPING.

The International Institute of Agriculture in Rome has been endeavouring for several years to introduce a system of international statistics based on agricultural book-keeping. In order to carry out a statistical scheme of this nature, it is indispensable that the conditions under which agriculture works should be studied in as many States as possible and by means of a special method, the results obtained being placed at the disposal of the International Institute of Agriculture. Further, for the success of such an undertaking the researches made must satisfy the two following requirements:

(1) The book-keeping system adopted must be as simple as possible, but sufficiently accurate to provide reliable figures. (2) The returns must be confined to the chief results of agricultural activity.

An attempt is made in the table appended, to lay down the main lines upon which this enquiry should proceed. The first essential is, on the one hand, to determine the cost of production, and on the other, to estimate the gross returns of the undertaking. It is then easy to calculate the net returns, viz., the actual returns on the capital outlay and returns from the actual work done. In the same way the various items of the gross returns and of the working costs are determined separately. On the other hand, no attempt is made to estimate the cost of production for each branch of the farm work, since this would necessitate too complicated a system of accountancy for the farmer who does his own book-keeping.

Thus, there is no need to enter the internal consignments from one branch of the farm activities to another. It is sufficient to register receipts and payments, and to note payments in kind made by the farm to the household, and to the farmer's private account, or any such payments made by the farm to the staff. An annual stock-

taking must also be made; this will show the changes in returns and, more especially, the changes in the supplies and the live-stock. As however, the agricultural workers do not receive all their wages in cash, but are generally boarded at the farm, a special record must be kept of the expenses of their maintenance. At the end of the year the sum representing the just compensation of the members of the family working on the farm must also be entered on the books, In carrying out the annual stock-taking any necessary amortisations must be considered, as these constitute an integral part of the farm expenses. By means of the above scheme and rules it will be possible to determine exactly the costs of production and the gross returns of the estate.

The books which a farmer-book-keeper needs are as follows: a cash-book for entering cash transactions; an inventory to show changes in income and a book of disbursements for registering all the payments made by the estate to the private account of the farmer and to the workers and *vice-versa*, in so far as they have not already been carried over to the cash-book. These three registers are the basis for the balancing of the accounts at the end of the financial year. Further details on this subject can be obtained from the publications of the " Secrétariat des paysans suisses " and from the works of Prof. LAUR.

In estimating the cost of production and the gross returns, no difficulty will be experienced if the items are grouped in a methodical manner under separate heads.

The total cost of production (or working expenses) includes cost of labour, the current expenses of the farm, amortisations, and the payment of interest on the capital. By subtracting the interest payment from this sum, the working cost of the farm is obtained. By gross returns should always be understood the " final gross returns ", that is to say, the actual value of the gains entered in the inventory and of the produce used on the farm itself. Thus the potatoes employed for feeding the pigs will not figure under the head of the gross returns from potato-growing, but under the pig-rearing returns. In the same way, the gross returns from the meadows only include increases according to the inventory and the sums realised from the sale of hay. The value of the hay fed to stock appears under the form of products such as milk, fatted beasts, breeding-stock, etc.

By subtracting the expenses of the farm from the gross returns, the net returns, are obtained, viz., the actual return on the agricultural capital. In the statistics the net returns are calculated per 100

francs of the capital, and like the working cost and the gross returns are reckoned per unit of surface. On subtracting from the gross returns the total costs of production, omitting the just remuneration of the members of the family, the actual return given by the work of the family is obtained, this figure being reckoned per man's working-day.

As a general rule, it may be said that the net returns are the best criterion of the condition of a large farm, while the labour results are the most satisfactory gauge of the prosperity of the small holding.

It would, no doubt, be well to arrange the results of the statistical researches according to the different types of farms. The scheme given below shows how they might be grouped.

(1) *Cattle-rearing farms:*
  (*a*) farms with extensive grazing ground;
  (*b*) Alpine farms;
  (*c*) other farms.
(2) *Dairy-farms:*
  (*a*) Farms with grass crops and pastures;
  (*b*) Farms with permanent or temporary meadows.
(3) *Cattle fattening farms:*
  (*a*) extensive grazing of steers;
  (*b*) intensive grazing of steers;
  (*c*) other types of fattening.
(4) *Other farms of which the returns are derived chiefly from cattle.*
(5) *Sheep-breeding farms:*
  (*a*) Sheep-farms for wool production and for rearing pure-bred sheep;
  (*b*) Sheep-farms raising sheep for the butcher, or where other types of work are carried on.
(6) *Pig-fattening farms:*
  (*a*) farms engaged in fattening pigs, or in other work;
  (*b*) farms entirely set apart for the fattening of pigs.
(7) *Farms exclusively for cereal cultivation.*
(8) *Farms where cereals and other crops are grown:*
  (*a*) cultivating hoed crops;
  (*b*) cultivating other crops.
(9) *Farms occupied in cotton cultivation:*
  (*a*) cotton plantations alone (monoculture);
  (*b*) mixed crops (cotton grown by general farmers).

(10) *Coffee growing estates:*
(*a*) with only coffee plantations (monoculture);
(*b*) mixed crops.
(11) *Rice-growing estates*:
(*a*) with only rice-fields;
(*b*) mixed crops.
(12) *Other farms; settlers' mixed farms:*
(*a*) farms cultivated to supply the owner's needs;
(*b*) peasant undertakings;
(*c*) commercial farms.
(13) *Vine-growing estates:*
(*a*) with vineyards only;
(*b*) with mixed crops.
(14) *Orchards and small fruit farms.*
(*a*) with orchards, and fruit-gardens only;
(*b*) with mixed cultivation.

The farms of each type should be subdivided into the following five groups:

(1) *Small peasant holdings* providing sufficient work for the owner and his wife, but too small to employ their adult children, or paid workers.

(2) *Average-sized peasant holdings* where the owner is assisted by his adult children, or by paid workers.

(3) *Large peasant holdings* where the farmer is entirely occupied in organisation and supervision and is assisted by foremen, who however help in the agricultural work.

(4) *Large farms* where the farmer is assisted by bailiffs or the like, who do not take part in the practical work.

(5) *Large landed properties* (latifundia). These estates are too large to be worked undivided, and consist of several farms connected with the central farm.

It is clear that all these five groups will not appear in each system of farming.

The chief aim of statistics of this character is to provide producers and consumers with accurate information respecting the returns on the capital outlay and the profit on the work of the agriculturist.

Further, in the course of years, reliable statistical data will be collected which can serve as a basis for fixing the prices of agricultural

TABLE II.

	Cost of production per hectare								Total cost of product	Net return (1)		Work yield per working day by the farmer's family (2)	Return from the property per hectare (3)
	Cost of labour		Current farm expenses	Amortization charges	Interest								
	Paid staff	Remuneration of members of the family			on the value of the land (including the improvements, cost of trees and money advanced, for next season's crops)	On value of the buildings	On the farm capital (livestock, dead stock, supplies, cash and credit)			in % of capital employed	per hectare		
1. *Cattle-breeding farms:*													
a) Extensive grazing farms:													
I. Small peasant holdings:													
Year* 1925													
" 1924													
" 1923													
II. Medium-sized peasant holdings:													
Year 1925													
" 1924													
" 1923													
III. Large peasant holdings:													
Year 1925													
" 1924													
" 1923													
IV. Large farms:													
Year 1925													
" 1924													
" 1923													
V. Large landed-properties (latifundia):													
Year 1925													
" 1924													
" 1923													
Total (*a*) Extensive grazing farms:													
Year 1925													
" 1924													
" 1923													
b) Alpine farms**													
c) Other farms													
2. *Dairy farms:*													
a) Farms with grass-crops and grazing grounds (natural													

3. *Cattle-fattening farms :*
   a) Fattening by grazing (extensive) . . . . . .
   b) Fattening by grazing (intensive) . . . . . .
   c) Others . . . . . .
4. *Other farms for which the returns come chiefly from cattle.* . .
5. *Farms entirely devoted to sheep-breeding :*
   a) Farms breeding wool-sheep and pure-bred sheep. . .
   b) Farms engaged in sheep-fattening or other work. . .
6. *Pig-fattening farms :*
   a) Farms employed in fattening pigs and in other work.
   b) Farms exclusively occupied in pig-fattening . . . . .
7. *Farms exclusively engaged in cereal cultivation* . . . . . .
8. *Farms occupied in cultivating cereals and other crops :*
   a) Growing hoed crops . . . . . .
   b) Growing other crops . . . . . .
9. *Cotton growing estates :*
   a) Cultivating cotton exclusively (monoculture) . . . . .
   b) Cotton and other crops . . . . . .
10. *Estates where coffee is cultivated :*
   a) Consisting exclusively of coffee plantations (monoculture) . . . . . .
   b) Coffee and other crops . . . . . .
11. *Estates where rice is grown :*
   a) With rice fields only . . . . . .
   b) Rice and other crops . . . . . .
12. *Other settlers estates with mixed crops :*
   a) Cultivated to supply owners requirements . . . . . .
   b) Other peasant holdings . . . . . .
   c) Commercial estates . . . . . .
13. *Vine growing estates :*
   a) With vineyards only . . . . . .
   b) With mixed crops . . . . . .
14. *Fruit farms growing fruit trees and small fruits.*
   a) exclusively ; . . . . . .
   b) Mixed . . . . . .

* Agricultural year. — (1) Net return = Gross return — (cost of production and interest charges). — (2) Work yield = Gross return — (cost of production and remuneration for work done by members of the family).— (3)Return from the property = net return —Interest charges on farm capital

produce and as a valuable basis for agrarian policy and political economy.

In order as for as possible to reduce the appended table, which gives the statistics for a *whole series of years*, the figures relating to the different States are not entered separately. On the other hand a second table is give in which the returns from *each State* are entered but for a single year only. Both tables are exactly the same with the exception that in the second the names of the various countries take the place of the dates of the years.

Prof. E. Laur,
Director of the Swiss Peasants' Secretariat, Brougg.

FUNCTIONAL DISEASES OF APPLES IN COLD STORAGE.

In recent years the practice of apple storage as an integral operation in the distribution and marketing of the apple crops of the world has been progressively industrialised. The apple crops are produced locally and over relatively short seasons. Hence in order to maintain a supply of apples for the big markets throughout the year, the fruit is both stored out of season and transported by season from regions where the ripening season occurs at a different time of the year.

For the industrial practice of apple storage on land and sea, mechanical refrigeration (cold storage) is now widely adopted. Concurrently with the adoption of refrigeration for the storage of apples on a large scale has come the recognition and definition of certain types of physiological or functional diseases (as distinct from fungal rots) which at times cause serious loss in large-scale operations.

Industry and science have at present scarcely passed the stage of defining and diagnosing the different forms of functional diseases which are now known to occur, and considerable confusion in nomenclature still exists. These diseases, however, have become the subject of intensive study in countries commercially interested in the apple trade, and the object of the present communication is to draw together as far as possible the threads of our present knowledge of this subject. The attention of the reader is particularly drawn to the series of figures depicting functional diseases of apples, which accompany the paper, and to the literature cited.

While the various functional diseases of apples in storage are due to different causes, in appearance these diseases are very similar. They possess a character in common, namely, premature browning of some part or the whole of the tissues of the apple. It is unfortunate that the classification of these diseases has been based entirely upon the appearance and distribution of the affected tissue and not upon the causal conditions. Confusion amongst investigators has risen

FIG. 76. — Scald on a green Bramley's Seedling apple. The flesh of the apple is crisp and sound. (Controlled by oiled wrappers).

FIG. 77. — Scald ("Spotting" type) on Newton Wonder apple.
The flesh of the apple is crisp and sound (Controlled by oiled wrappers).

owing to the fact that identical appearance and distribution of the browned tissue may occur from widely diverging causes.

To the industry it is obviously of first importance to be able to diagnose a disease in relation to its *causes*, and it follows therefore that identification and prevention of physiological diseases will necessitate the taking of accurate records of conditions, not only in storage but also in the orchard, as a routine operation in the trade.

The possibility of the existence of chemical, microscopical or physical criteria which can be used by the trade to identify functional diseases, indistinguishable in appearance but differing in causation, opens up an important field which is as yet unexplored.

Class I : Scald.

Browning of the superficial cells of the (Plate XXXVII, Fig. 76) *unaccompanied by softening or browning of the flesh. Controlled to some extent by efficient ventilation, and very largely by the use of wrappers impregnated with odourless mineral oil. Under this category may be included the various " spotting " diseases of apples which are not due to fungi.*

Description. — The most comprehensive and best known contribution to the study of apple scald is that of Brooks, Cooley and Fisher (7) who describe it as follows : " In mild cases of scald the apple is merely tinted with brown, the skin remaining firm, but in more severe cases the skin tissue may be broken down to the extent that it sloughs off readily from the underlying flesh . . . Scald differs from all other apple diseases in being more prevalent on the green side of the apple. Bright red fruit surfaces are highly resistant to scald, and yellow surfaces are much more resistant than those that are green or show the first stages of turning from green to yellow . . . An apple that has had its skin killed by scald becomes the ready prey of the various rot organisms, and they soon finish the work of destruction that the scald has begun." These authors also point out that, under the prevailing methods of handling fruits in the United States, scald causes greater losses than all other storage diseases combined.

Causal Conditions and Control Measures.

A) *Before Storage.* — There seems to be general agreement amongst those who have studied scalding of apples that fruit which

is picked green is more susceptible to the disease than that which is more matured (POWELL and FULTON (12), RAMSEY, MCKAY, MARKELL and BIRD (1) (13) and WHITEHOUSE (16). RAMSEY and his co-workers state that " the amount and severity of scald in immaturely picked apples in cold storage are often enormous. As the picking season advances and the fruit matures and colours, the damage decreases, until at full maturity the scald is comparatively slight." WHITEHOUSE (l. c.) states that " the right degree of maturity of apples when they are put into cold storage is the prime consideration in the control of apple scald. Immature fruits scald readily in storage."

From the results of their experiments BROOKS and FISHER (4) conclude that apples from trees receiving heavy irrigation are more susceptible to scald owing to the forcing effect of irrigation. The present authors have found that apples of young trees often scald more readily than those of older trees, and the fact that scald develops more readily in some seasons than in others has long been known.

B) *During Storage.* — The authors agree that in any uniform sample of fully matured apples scald developed more slowly the lower the storage temperature, and consequently a well controlled storage temperature of 32° to 34° F. is of great importance in controlling the amount of scald appearing in any given time during the commercial storage season.

The combined operation of the degree of maturity at the time of gathering and the temperature of storage have an important and interesting bearing on the debated question as to whether " delayed storage ", in other words, holding apples for a short period at ordinary temperature before placing them in cold storage, is beneficial or otherwise, with regard to scald development. Absolutely contradictory results have been obtained, but an explanation of these divergent results has been given and established experimentally by WHITEHOUSE (l. c.). If the apples are immature on gathering a period of delayed storage is beneficial because it allows the apples to mature at the higher temperature after gathering. If, however, the apples are gathered after full maturity, delayed storage has no beneficial

(1) RAMSEY, MCKAY, MARKELL and BIRD (13) make no sharp distinction between " scald " and " physiological decay ", and it seems quite possible that they are dealing throughout with the functional disease termed " internal breakdown " by the present authors. The excellent coloured illustrations of cross-sections of apples shown in their paper would appear to illustrate typical " internal breakdowns "

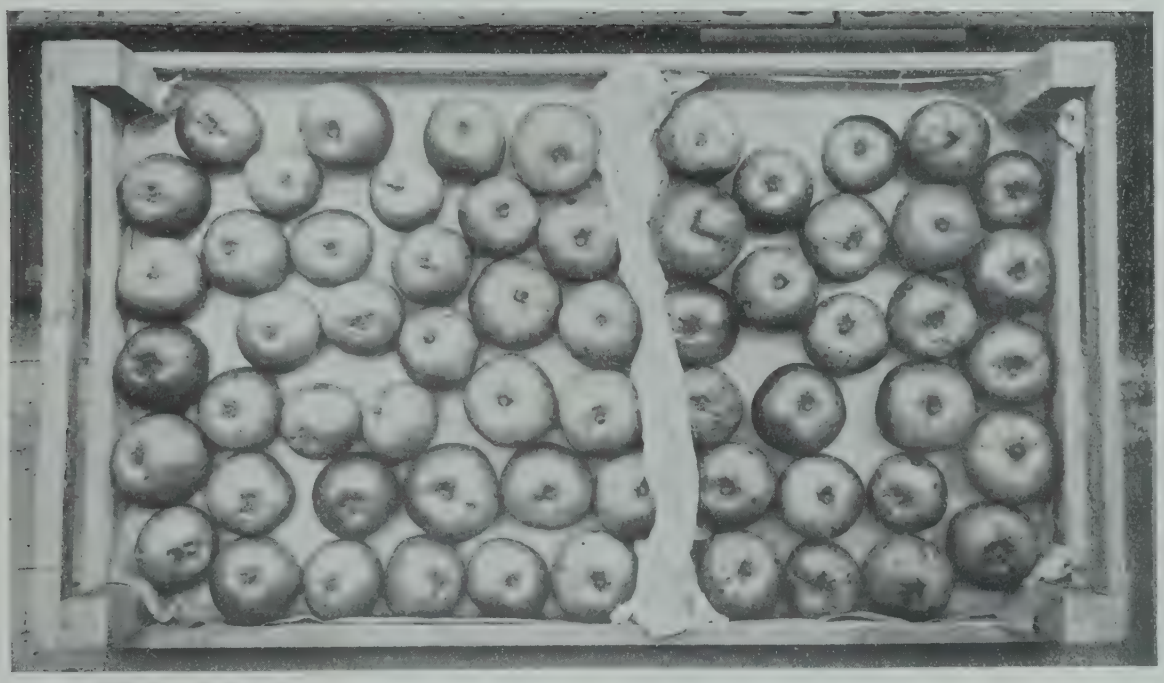

FIG. 78. — Control of "spotting" by the use of oiled wrappers.
The apples shown in this figure had been in storage for several months.

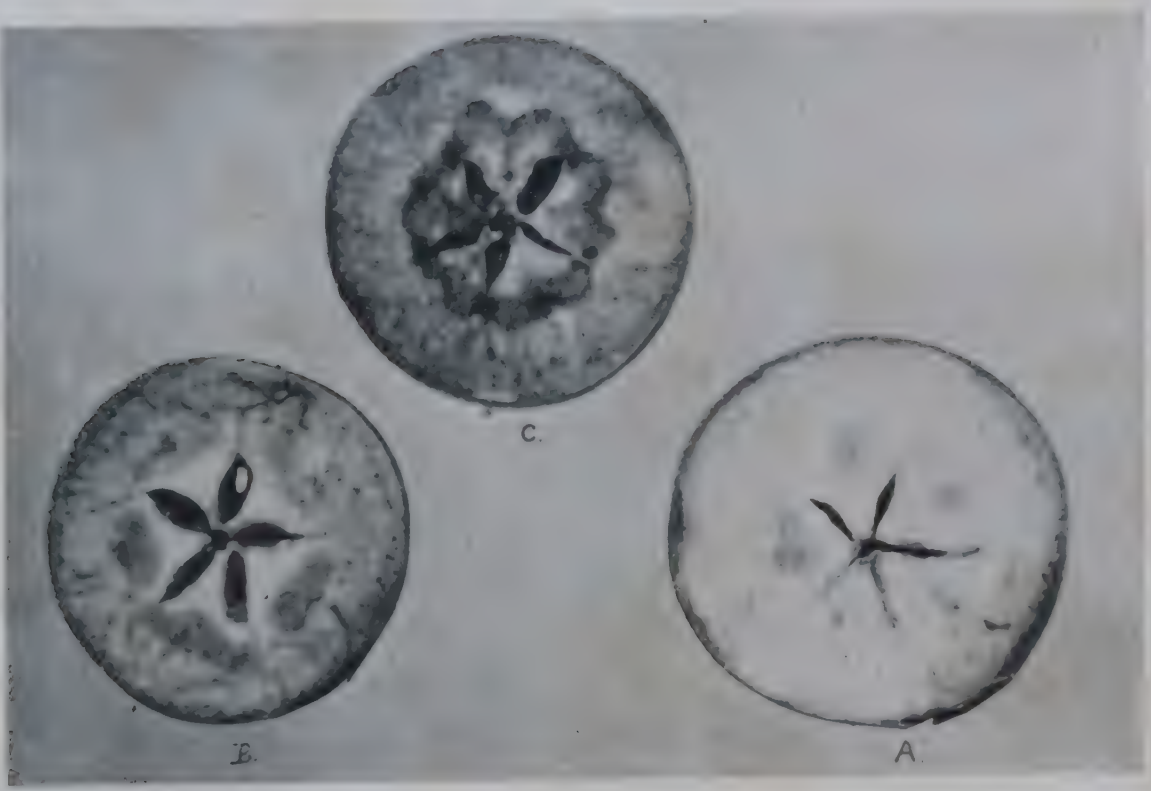

FIG. 79. — Three stages of "internal breakdown" in King Pippin apples (off chalk soil) stored at 34°F. The apples appear sound externally except in severe cases of the disease. Note early stages of "internal breakdown" in the pith and cortex.

FIG. 80. — Three stages of "internal breakdown" in King Pippin apples (off loam soil) stored at 34°F. The apples appear sound externally except in severe cases of the disease.

effect on the development of scald, but rather the reverse, owing to the fact that scald develops more quickly at higher temperatures. The practice of delayed cold storage is of importance where premature gathering is necessitated by early frost, premature droppings or exigencies of labour.

We are indebted to BROOKS, COOLEY and FISHER for the discovery of the most satisfactory control measure for scald yet known.

This consists in the use of tissue-paper wrappers impregnated with odourless mineral oil. The wrappers should carry at least 15 % of oil. They also found that relatively rapid air movement over apples decreased scalding to a large extent. A consideration of these control measures has led BROOKS and his co-workers to put forward the hypothesis (5, p. 240) that " the disease is due to the accumulation of esters or similar products of the apples in the tissues of the fruit and in the surrounding air. The vapours of these substances can be carried away by air currents or absorbed by fats and oils ".

Control measures for apple scald are most necessary during the period of storage immediately after gathering. BROOKS, COOLEY and FISHER (8) state that during the first six or eight weeks of storage " the scald-producing agencies are apparently most active, yet up to the end of the period it is possible largely or entirely to overcome any accumulated tendencies to the diseases by wrapping the apples in oiled paper or by giving them a very thorough airing. The second stage of the development of scald extends over a period of five to eight weeks following the first period. Preventive measures now become of little or no avail. The apples may be destined to scald if given sufficient time, yet if removed from storage before the end of the five to eight weeks they do not show scald, even upon warming. If the apples are consumed before the end of this second period the scald problem is avoided. The third period starts with the end of the second period and covers the remainder of the time the fruit is in storage. The apples now become latently or potentially scalded ; certain skin cells are practically dead, yet they remain green and appear normal if not exposed to warm air."

In addition to typical scalding there appears to be a " spotting " disease of apples which is particularly prevalent in some varieties and which in certain seasons occurs with many varieties (PLATE XXXVIII, FIG. 77). It is characteristic of this disease that spots appear at the lenticels and develop slowly as brown, somewhat sunken areas which, on cutting the apple, are seen to be confined to the surface.

Examination of these spots generally, but not invariably, reveals the presence of fungal organisms, which, however, are also usually to be found in perfectly healthy lenticels. The fact that fungi are present has opened up the question as to whether these organisms are primarily responsible for the disease or whether their presence is only incidental. This "spotting" disease has been included as a physiological disease under the heading of "scald", because it has been found that the use of mineral oil wrappers successfully controls its occurrence (PLATE XXXIX, FIG. 78). (See *Annual Report of the Food Investigation Board for the Years* 1921-22).

CLASS II: INTERNAL BREAKDOWN.

Premature browning of the flesh of the apple with or without mealiness. Tissues not necessarily dead.

Under this category may be included "internal browning", "soft scald", "flesh collapse", "Jonathan scald" and "physiological decay" (1).

"Internal breakdown" seems to be particularly a disease of cold storage and is seldom found in ordinary storage at ordinary temperatures. It is not due to freezing although often indistinguishable in appearance from frost injury. It has, in fact, often been mistaken for the latter, and the wide-spread nature of its occurrence as a distinct disease under cold-storage conditions and its consequent importance to the industry are now being realised in the apple producing countries of the world.

The present authors have found in their experience with English apples in cold storage that "internal breakdown" differs widely both in its external and internal appearance according to the variety of apple, the stage of maturity and other conditions, but that a relatively sharp distinction can be drawn between "scald" which browns the skin only and leaves the underlying flesh sound, and all forms of "internal breakdown."

(1) Multiplication of names for the same disease retards progress. Our reasons for classifying these diseases under one name, i. e. "internal breakdown", are possibly that we have found types of "internal breakdown" corresponding in appearance to the descriptions of "internal browning", "soft scald", "flesh collapse", "Jonathan scald", and "physiological decay", and secondly, that the causal conditions in all cases seems to be the same, namely low temperature.

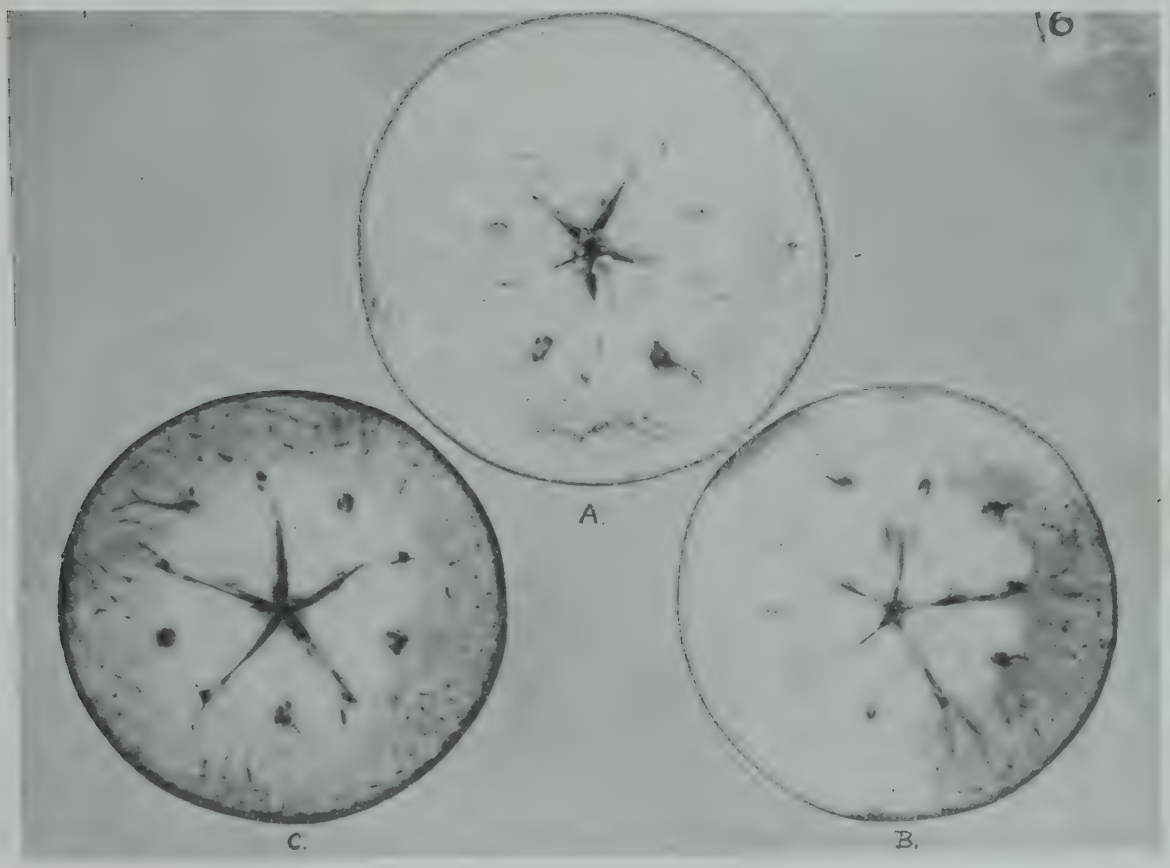

FIG. 81. — Three stages of "internal breakdown" in Cox's Orange Pippin apples (off chalk soil) stored at 34° F. Note that early stages of "internal breakdown" are confined to the cortex.

Owing to the injection with water of the intercellular spaces immediately beneath the skin, the affected tissue is clearly visible on the surface as a dull brownish band round the centre of the apple.

FIG. 82. — Four stages of "internal breakdown" in Bramley's Seedling apples (off England), stored at 37°F. Note cortical origin of the disease which spreads outwards to the skin, giving the apple a blotched brownish green appearance.

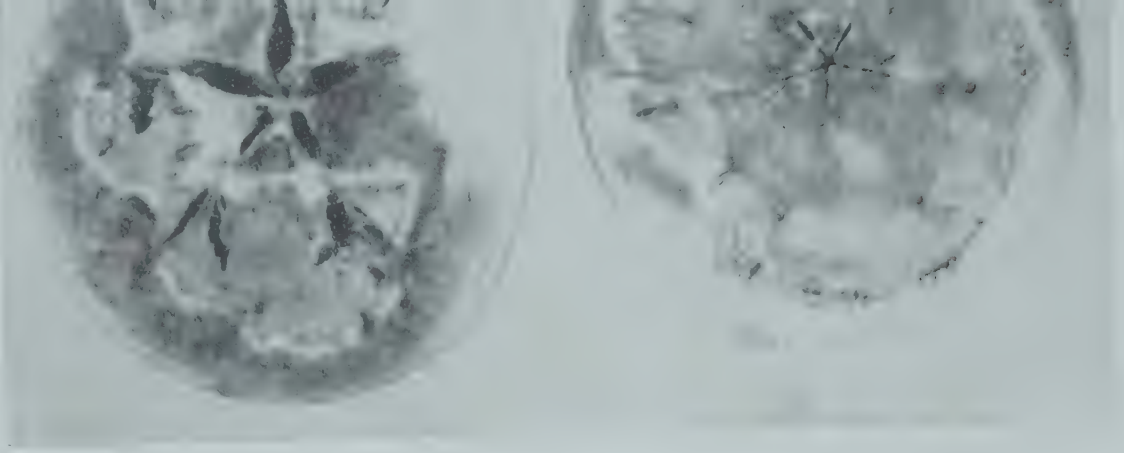

FIG. 87. — "Internal breakdown" following "brown heart" in Newton Wonder apples. Note the zone of white healthy tissue between the browned areas.

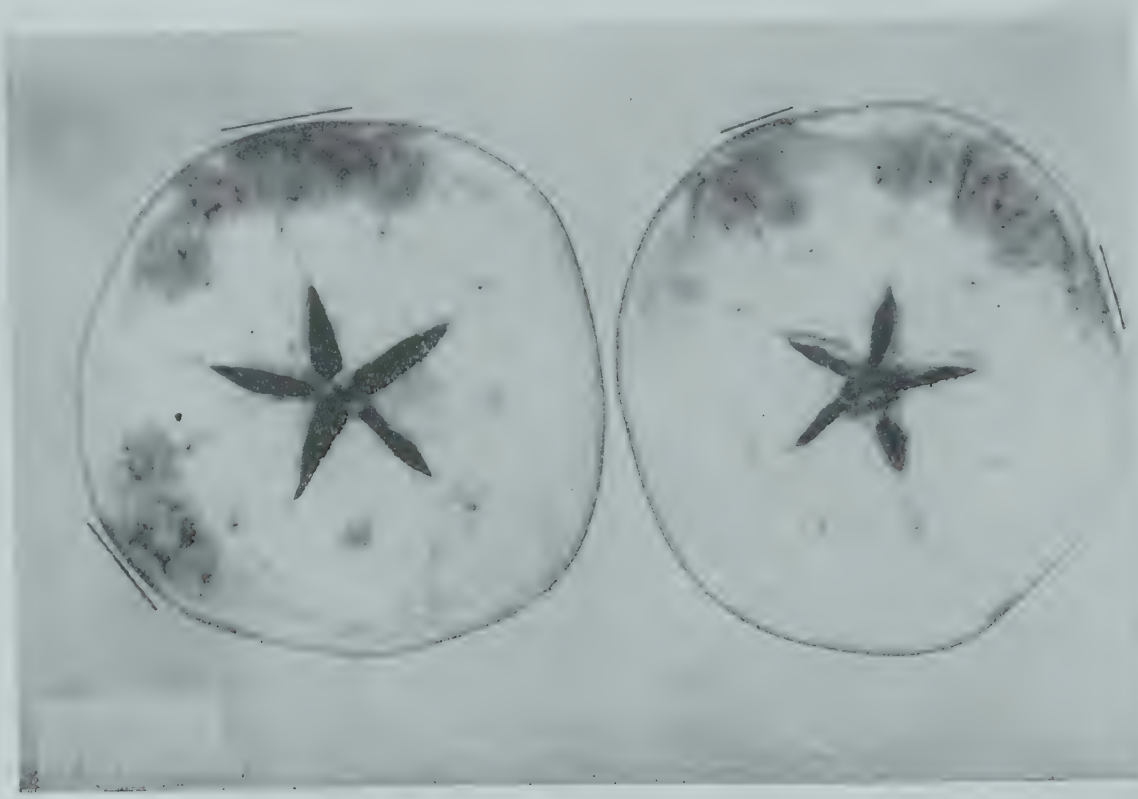

PLATE XLIII.

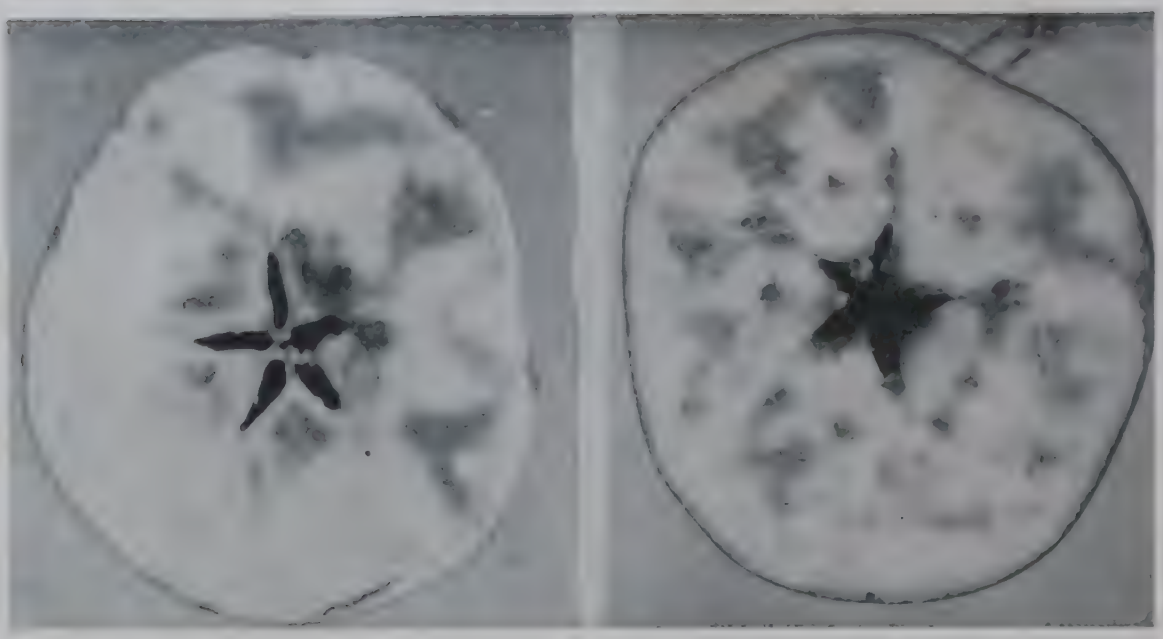

FIG. 85. — "Internal breakdown" in Bramley's Seedling apples (off silt soil) stored at 34°. The flesh of these apples was firm and juicy, and their external appearance was perfect.

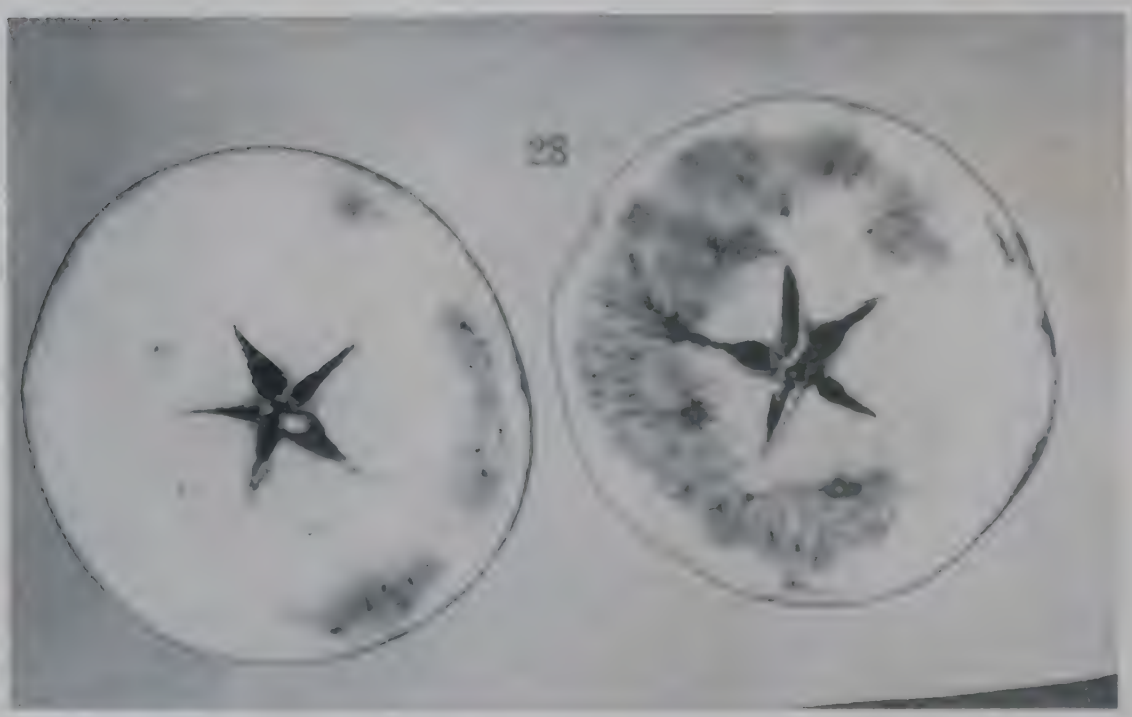

FIG. 86. — "Internal breakdown" in Blenheim Orange apples. These apples appeared to be sound until they were cut

The following points should be noted:

(1) The common feature of all types of "internal breakdown" is a browning of some part or of the whole of the flesh of the apple (PLATES XL-XLIV, FIGS. 79-86). The cells of the tissues in the early stage of this disease retain their turgidity.

(2) The brown tissue may or may not extend to the skin, hence affected apples may show all degrees of external disfigurement (PLATES XLI-XLIII, FIGS. 81-84), or the disease may be undetectable on the surface (PLATE XLIV, FIGS 85-86).

(3) In general, internal breakdown is accompanied by softening of the flesh tissue, so that it can be easily mashed into a paste with the fingers, but this is not an invariable characteristic.

(4) A characteristic of internal breakdown, which appears to be general, is that if any previous injury resulting in killing of tissue has occurred, for example, "bitter pit", "bruising", "brown heart" etc., a zone of healthy white tissue remains around the injured parts when "internal breakdown" develops (See PLATE XLIV, FIG. 87).

Suggested Causal Conditions and Control Measures.

The investigations of RAMSEY, MCKAY, MARKELL, and BIRD (l. c.) indicate that apples which are either immature or overripe when gathered, are much more liable to "physiological decay" in cold storage, and therefore the most effective method of control is to gather the fruit at the right stage of maturity, namely, when "the ground colour, which is green when the fruit is immature, begins to whiten or yellow slightly as it approached full maturity" (l. c., p. 16).

A series of investigations carried out by STUBENRAUCH (14), BALLARD, MAGNESS and HAWKINS (1) and WINKLER (17) have centred on the development of "internal browning" in cold-stored apples from the Pajaro Valley district of California, particularly the Yellow Newton apple. These investigations, which extend over a number of years, seem to indicate that the cause of the peculiar susceptibility of the Yellow Newton apple from this district is related to a low average orchard temperature during its development on the tree. "Internal browning" in cold storage was found to be less severe when there was a heavy crop than when there was only a light crop of large sized apples.

The storage trials of these workers show clearly that the browning occurs earlier and to a more serious extent when the apples are stored at 32° to 34° F. than when stored at somewhat higher temperatures (FIG. 88 in text). The method of control is therefore the adoption of a storage temperature not lower than 36° F. for these apples.

The results obtained by MAGNESS and BURROUGHS (10), with regard to the occurrence of " soft scald " in Rome Beauty and Jonathan apples at different storage temperatures, fall in line with those quoted above with regard to " internal browning ". No " soft scald " developed in cellar storage, and only to a slight extent in storage at 35° F., whereas at a lower storage temperature of 32° F., " soft scald " was very severe. The authors make it quite clear that the incidence of the disease is not to be attributed to lack of aeration.

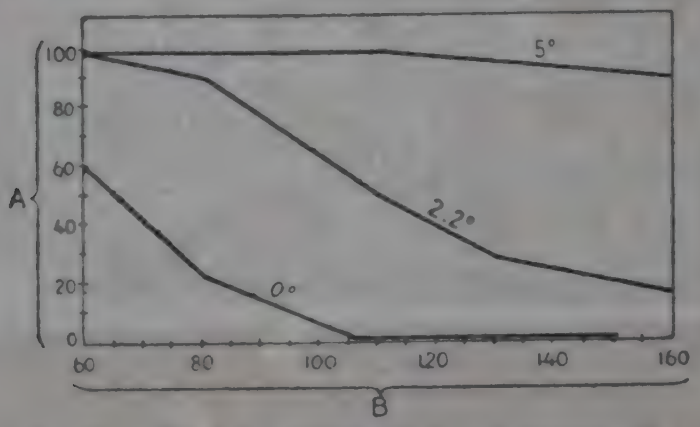

FIG. 88. — Effect of temperature on the preservation of apples (after WINKLER).

A = Percentage of normal fruit ;
B = No. of days kept in preservation.

Lastly we may consider the " flesh collapse " of the New Zealand apple trade. This disease is described by WATERS (15) as occurring in its early stages as a narrow band of pinkish brown soft flesh running parallel to the skin. The brownish condition, however, may involve a much larger portion of the flesh ; in fact, the whole of the interior of the apple may be thus damaged whilst the skin shows little or no sign or injury.

With regard to cause and control, the only outstanding fact amongst the published results of investigations in New Zealand, which has come to our notice, is that locality plays an important part in determining susceptibility to the disease. For example, MCCLELLAND and TILLER (11) of the Cawthron Institute, working with Sturmer Pippin apples, found in the case of apples from one locality 5 per cent with severe " flesh collapse " after six months cold storage, as compared with 52 per cent in apples from another locality.

FIG. 89. — Shows the internal conditions of Adams Pearmain apples from a refrigerated hold on arrival in England from Australia. These apples appeared sound. externally.

FIG. 90. — Similar apples enlarged.

FIG. 91. — Dried out "brown heart" in Sturmer Pippin apples. This photograph was taken after the apples had been in kept in a room at ordinary temperatures for six months. The disease does not spread after removal of causal conditions.

FIG. 92. — Early stage in a Worcester Permain apple of "brown heart". Note origin at the main vascular bundles. Severe brown heart in a Newton Wonder apple. The browned tissue is not dried out

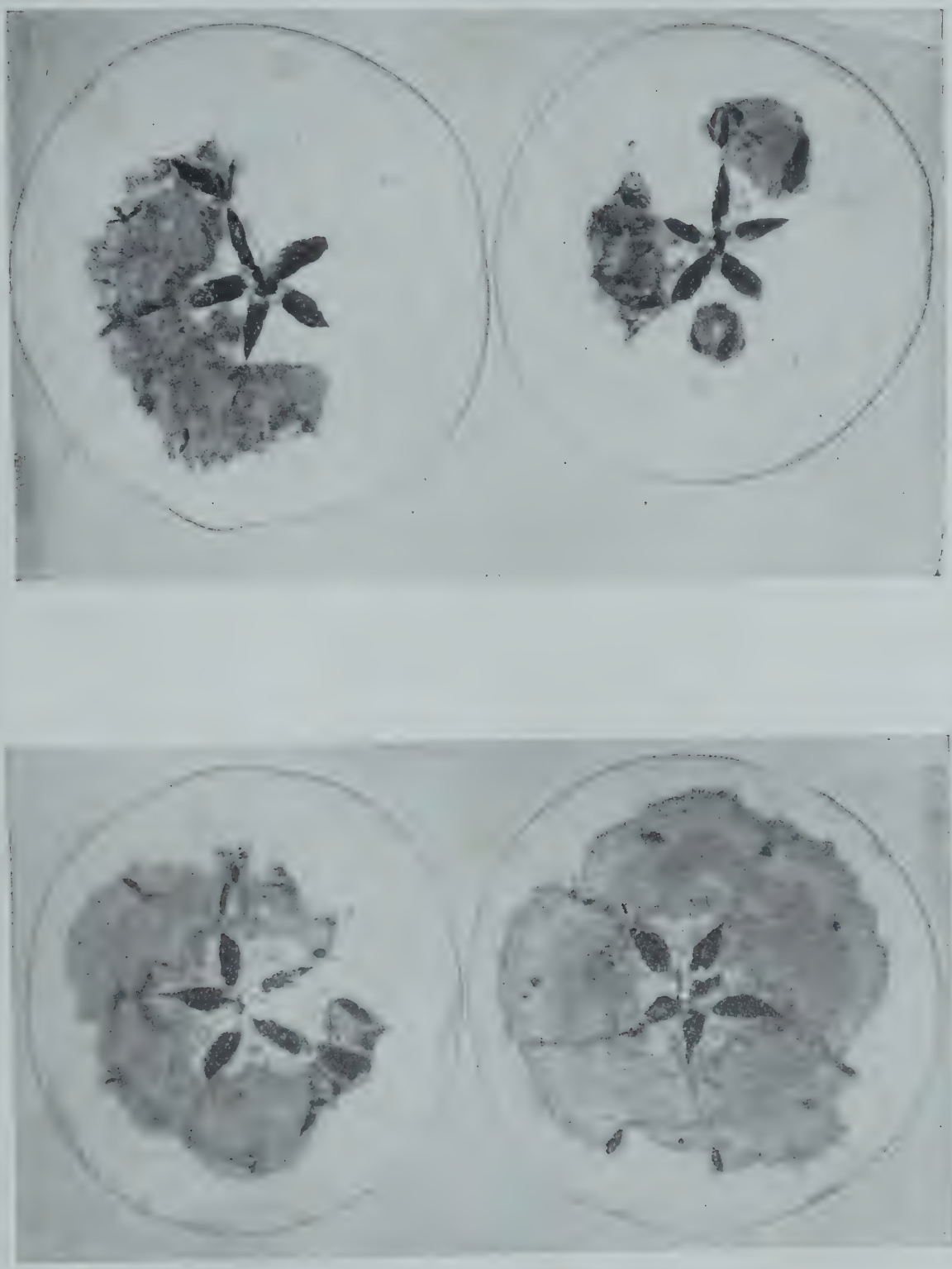

FIG. 93 and 94. — Stages in the development of "brown heart" in Newton Wonder apples. The browned tissue is partially dried out.

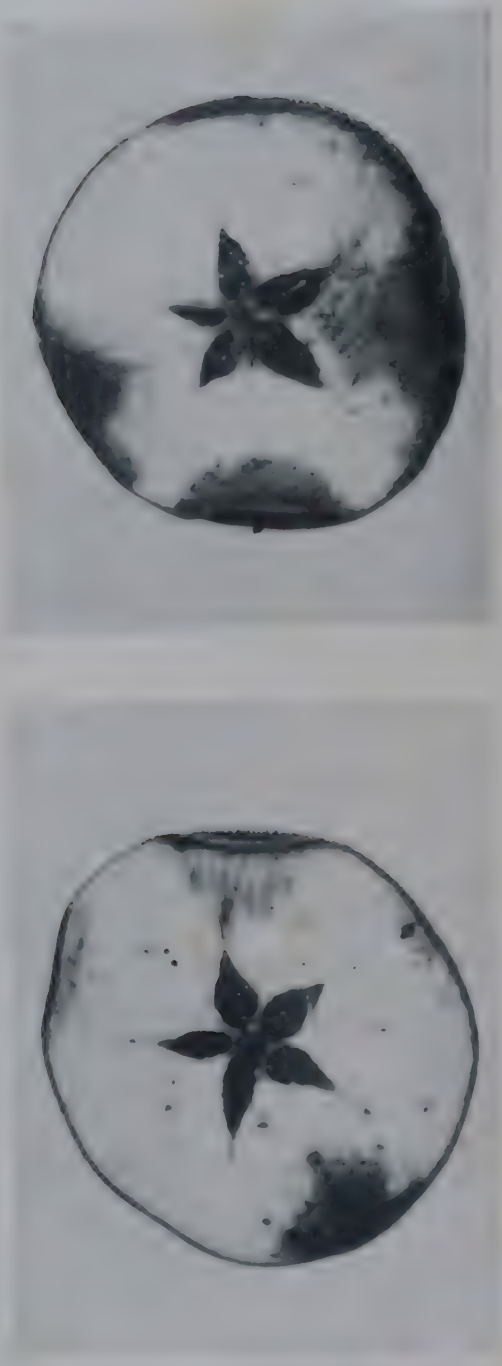

FIG. 95. — Two Golden Pippin apples showing frost injury (From a refrigerated cargo).

Class III: Brown Heart.

Premature browning of the flesh of the apple. The tissue is killed, collapses and finally dies out. Causal conditions: — concentration of carbon dioxide in the storage atmosphere above a certain limit, oxygen being present. Under otherwise similar conditions apples are more susceptible to " brown heart " in cold store than in ordinary store. Method of control: — ventilation.

The conditions giving rise to " brown heart " in cold storage are not likely to occur except under exceptional circumstances, when the storage chambers have relatively gas-proof walls and when no ventilation is given. Such conditions, however, occur in ships' holds and the " gas "storage method is used (1).

In the case of the carriage of apples in refrigerated holds on voyages of several weeks duration three main systems of refrigeration are employed. These are usually spoken of as the " battery " system, the " cold air " system and the " grid " system.

In the first two systems forced air circulation is employed, which incidentally provides considerable ventilation of the holds. In the " grid " system, on the other hand, there is no forced air circulation, and the ventilation which does occur through accidental leakage has sometimes been insufficient, with the result that very severe losses have been sustained owing to the occurrence of " brown heart " due to excessive accumulation of carbon dioxide in the hold.

The appearance of " brown heart " needs no special description in addition to the various figures shown (See Plate XLV, Fig. 89, Plate XLVII, Fig. 94). Its most distinguishing characters are firstly, that the brown tissue is killed and hence rapidly loses water to the adjacent living tissues so that cavities are eventually formed. For the same reason, when an apple is cut across, the exposed surface dries up much more rapidly in the region of the affected tissue. The second characteristic feature of this disease is that the external appearance of affected apples, except in extreme cases, is perfectly normal.

Thirdly, when the causal conditions are removed the disease does not spread (Plate XLVI, Fig. 91). Lastly, it may be induced at any stage in the storage life, and appears in its most characteristic form when it occurs early before the tissues of the apple have softened and ripened.

(1) For an account of the " gas "-storage method the reader is referred to the Annual Report of the Food Investigation Board for the years 1919-22 inclusive.

CRYPTOGAMIC EPIDEMICS AND THE ENVIRONMENTAL FACTORS THAT DETERMINE THEM.

The occurrence of certain cryptogamic epidemics in cultivated fields, or among plants in general, is not sufficiently explained by an exact and detailed knowledge of the parasitic species of fungus, its usual location, etc. The presence of rust, oïdium, and peronospora, is in fact, so intimately connected with the climatic factors of the environment that the attack of the fungus, as well as the susceptibility of the host-plant, are generally recognised by writers on the subject to depend upon ecological conditions.

This being the case, the study of the environmental factors determining, or rather, favourable to the outbreak of cryptogamic epidemics, the form of disease most commonly met with among plants, should be pursued along two quite separate and distinct lines. It is necessary to study both the factors inducing fungus attack and also the causes determining the susceptibility of the organ of the host-plant. In this way, it is possible by means of independent researches to understand the interactions, and opposing influences that are to be met with in nature.

For several successive years, I had the opportunity of observing the appearance of oïdium on various plants, such as wheat, the oak, the spindle-tree and the rose, and have been able to obtain a fairly correct idea of the first group of causes predisposing the plants to attack, that is to say, determining their susceptibility. These causes are of one type, as will be explained later.

Afterwards, I tried by means of suitable tests to discover the conditions determining the resistance of the conidia, or fungus spores, instrumental in spreading the disease, in order to understand the factors promoting or hindering the development of these bodies which occur in extraordinary numbers on the infected leaves every day of the host-plant's growth.

Thousands of these spores are present in the air in the early

morning, during spring and summer, and as they settle upon the green organs of plants, it would seem that the plants could not escape infection, but as a matter of fact, they are not attacked every day, or habitually and continuously throughout their lives, but relatively, only a few times a year, so that the percentage of " actual attacks " is very small as compared with the " possible attacks ".

The relative rarity of infection would appear to depend (according to the tests and observations made in this connection), upon two groups of environmental factors, viz., those possessing the power of destroying the fungus, or rendering it innocuous, and those producing a temporary resistance in the susceptible plants.

The data collected allow it to be assumed that a hot sun, absence of moisture and dry surroundings, are generally inimical to the fungus, whereas damp and warmth promote the germination of the spores and encourage their attack on the host-plant, but in the case of oïdium, although doubtless the direct rays of the sun weaken and destroy a large number of the spores, unfavourable conditions of the environment, such as drought and a high temperature in the absence of sunlight (such as occur for instance on summer nights) have not, as a rule, proved fatal to the parasite.

Since the fungus, owing either to its continual and copious emission of spores, or to its relative resistance to adverse external factors, is often present in large masses upon its host, the outbreak of the disease depends more upon the effect of the environmental factors determining the resistance and the susceptibility of the plant than upon those influencing the parasite and its powers of attack.

***

The careful study of successive and frequent cryptogamic attacks produced artificially on plants in the greenhouse have clearly shown the " moment of least resistance " in the infected organ to occur during a period of flaccidity, or rather of partial wilting, of the host-plant's tissues. Green organs at the height of their maximum turgidity prove themselves to be relatively or absolutely resistant, so that the attacks made upon them by the continual deposition on their surface of large numbers of conidia remain partially or wholly abortive. The spores germinate, but the host suffers little if at all, since its extreme turgidity protects it against the penetration of the fungus hyphae. For this reason, the classical infection in the

moist chamber regularly fails in the case of turgescent and erect organs.

On the other hand, the plant, proved susceptible to the artificial infection experiments when its organs were slightly wilted; in fact, the attacks occurring in the moist chamber on plants in such a condition are most serious and may even have fatal consequences.

Oïdium attacks can be artificially induced by putting green-house raised plants under a bell-glass full of moist air containing a large number of spores and then exposing them suddenly to direct sunlight. The flaccid leaves of such plants fall an easy prey to the parasite, whereas plants reared in the open air and in sunshine, since their organs are turgid and erect, if introduced under the same bell-jar, prove wholly or partially immune.

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The " moment of susceptibility " of the organ having thus been determined, the observer can have a clearer idea of the complicated question of the temporary susceptibility and resistance shown by host-plants to the attacks of the parasite.

The numerous observations of various writers that have been collected and arranged by COMES can now be co-ordinated, for through them all runs a thread of logic hitherto sought for in vain in other directions, even by COMES himself.

The striking susceptibility produced by fertilisers, especially nitrogenous fertilisers, which has been observed and recognised by all investigators, can be explained in the case of the oïdium hosts, chiefly if not exclusively, by the more frequent periods of decreased turgidity to which these plants are subjected.

The undoubted greater susceptibility shown by young, tender leaves and petioles as compared with older organs of the same type is due, at all events in a certain degree, to their different behaviour during the hot hours of spring and summer, when the young leaves often flag from the loss of water caused by the burning sun, whereas the older organs remain turgid and erect throughout the day.

The fact that regularly irrigated plants with luxuriant leafage fall an easier prey than others to fungus attack, also admits of a natural explanation in the readiness with which, owing to their

special structure and constitution, the organs of such plants wilt, or at any rate, to some extent lose their turgidity.

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This special mode of accounting for susceptibility in cases of infection by the *Erysipheae* must be kept well in mind in taking into consideration the conditions preceeding and accompanying fungus attacks in general, for although not many data have so far been collected as to the possibility of fungus infection being preceeded by a clearly recognised and easily detected weakness of the host-plant attacked, yet it may logically be assumed "a priori," given the simple structure and functioning of plants, that other attacks of fungi may also be accompanied or preceded by similar loss of vigour (decrease in the turgidity of the green organs), so that the theory may have a more extended application.

From what has been affirmed by experts, it appears that the susceptibility of other host-plants to other cryptogamic infections depends on a cause similar to that verified in the case of oïdium, but at present, the experimental data on this subject are too few to warrant our making general assertions on the basis of the behaviour of oïdium, although it is satisfactory to note that DUCOMET records similar facts in connection with the *Rhioctonis* of the potato. It is, however, most important to report the behaviour of plants in this connection, for the predisposition and the resistance shown by the host to the attacks of oïdium are, in my opinion, the explanation of the special problems that form the basis of modern phytopathology and therefore merit special study.

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The environmental conditions accompanying the outbreak of cryptogamic epidemics must thus be considered under two distinct heads: (1) those favourable to the fungus; (2) those predisposing the host-plant to attack.

From the examination made above, it may be assumed that the external factors favouring susceptibility, viz., dry air, and more especially drought accompanied by a burning sun, are those that most

frequently predispose the plant to attack, and at the same time are the greatest hindrance to the development of the fungus spores whose very existence they indeed threaten, whereas a mild temperature and moist air, while they are favourable to the preservation and the germination of the fungus, usually insure the maximum turgidity of the green tissues of the host-plant and therefore determine the relative or absolute resistance of the plant to fungus attack.

This strange state of affairs which renders coexistent the two opposite factors, susceptibility-absence of fungus, and resistance-presence of fungus is the constant rule under normal meteorological environmental conditions, and explains why the fungus, although it continually produces incalculable numbers of spores, rarely succeeds in destroying its host, which escapes nearly all the attacks, and when in exceptional cases, it falls a victim, the attack is not continuous, nor does it occur every day, like the production of the conidia, but only a few times a year.

The fact that external conditions that assist the fungus generally tend to increase the resistance of the plant, while the latter is most susceptible at the time when the fungus is usually absent or inert, throws light on those complex phenomena of biological regulation that make agricultural disaster due to fungus attack, of relatively rare occurrence, although the parasite persists in its conidial form through seasons and even years without the host-plant ever getting the better of it.

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There are, however, more or less marked exceptions to the rule based on the expressions, susceptibility-absence of fungus, and resistance-presence of fungus. These exceptions clearly explain the outbreak of certain memorable cases of epidemic disease that have also been artificially reproduced on a smaller scale in the laboratory. The antithetical conditions of which we have spoken, if they cannot actually coexist in nature, may yet immediately follow one another, in which case, the first determines the predisposition of the plant, while the second comes into play immediately after (while the effect of the first producing the susceptibility of the plant still lasts), thus protecting and stimulating the diffusion and

germination of the fungus conidia ; or else environmental conditions determining the diffusion and germination of the fungus spores may be followed by other and contrary external conditions which are not sufficiently pronounced to be fatal to the fungus, yet have the effect of rendering the host-plant susceptible to attack.

Instances of the first group of phenomena are frequently to be observed in early spring, when the first hot days disturb the functional equilibrium of plants accustomed to a cold or cool climate. The green tissues at this time become flaccid during the hot hours, and later, the high temperature in the day followed by a colder temperature at night produces thick masses of mist in the damp valleys. These mists transport and diffuse the conidia which fall fresh and full of vitality in large numbers upon the green organs of the host-plant, where they find ready entrance owing to the loss of turgidity of the tissues, which have not suceeded in recovering during the night to the point of being able totally to resist the fungus.

However little we realise it, not one, but several cases are to be found in which the successive changes in the meteorological phenomena allow these epidemics to make their appearance, yet it remains a fixed principle that the same environmental condition that is favourable to the fungus determines the resistance of the host-plant, while the factors that cause the susceptibility of the latter also hinder the development, and even threaten the existence, of the spores by means of which the fungus is disseminated.

V. Rivera,
Lecturer in the University of Rome.

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AGRICULTURAL INTELLIGENCE

AGRONOMY

Soil Science.

583. **The Leaching of Alkali Soils.**

GREAVES, J. E.; HIRST, C. T., and LUND, Y. (Utah Experiment Station). *Soil Science*, Vol. XVI, No. 6, pp. 407-426, bibliography. Baltimore, U. S. A., 1924.

This article gives a report of work undertaken to ascertain the rapidity with which salts leach from different soils, the quantity of the plant-food removed by leaching, and the chemical changes which have resulted from the action of the various salts upon the soil and their removal. Natural alkali soil behaved similarly to non-alkali soil treated with a mixture of the salts, sodium chloride, sulphate and carbonate.

Sodium sulphate leached rapidly, 88.8 — 97.7 % passed into the first drainage water, as compared with 71.6 — 94.5 % of the chloride. Soil treated with sodium carbonate leached slowly; 21.6-66.9 % was recovered. It was therefore impossible to free a column of soil one foot in depth from sodium carbonate to such an extent that crops would grow upon it.

From 1.2 to 16.4 times as much lime was leached from alkali soil as from normal soil.

From 3.6 to 23.3 times as much phosphorus was leached from the treated as from the untreated soil.

The early leachings from the prepared and natural alkali soils were very rich in potassium. The greatest quantities of potassium were made soluble by the chloride, less by the sulphate and least by the carbonate.

In every case the salt-treated soil lost more nitrogen than the untreated soil.

The results suggest that the long unproductive period following the drainage of alkali soil is caused by: *a*) the leaching of much of the available plant-food which makes necessary a period of weathering before sufficient is again available for crop production, *b*) the poor state of tilth of the drained soil and sometimes *c*) a toxic lime-magnesia ratio. W. S. G.

584. **The Liberation of Potassium from Feldspars.**

VANDECAVEY, S. C. (Iowa Agricultural Experiment Station). *Soil Science*, Vol. XVI, No. 6, pp. 389-406, bibliography. Baltimore, U. S. A., 1924.

A thorough understanding of the various agencies involved is essential in order to formulate any scheme of soil treatment which will enable economical use to be made of the abundant supply of native soil potassium. Carbon dioxide, bacteria, mineral and organic acids, and decaying organic matter all have some influence in making soil potassium available. The object of the author's experiments was to ascertain the relative effects of these various factors; some of the conclusions reached were as follows:

A manure extract and a combination of manure extract and acids, gave a decided increase in water-soluble potassium from finely ground orthoclase and alunite in water solutions. Sterilization and the addition of acids, calcium carbonate, and calcium sulphate did not increase the water soluble potassium of the same minerals.

Relatively small amounts of calcium sulphate added to Carrington loam caused an increase in water-soluble potassium, whereas calcium carbonate and acid phosphate did not have the same effect.

Moulds caused a decided increase in carbon dioxide and a smaller increase in soluble potassium in sterilized soil. An increase was caused by organic matter such as manure and clover hay, also by a combination of acids and organic matter.

The production of carbon dioxide did not prove to be an index of the quantity of water-soluble potassium liberated. Sterilization resulted in an increase in the concentration of the soil solution and in the amount of water-soluble potassium. The reaction of the soil showed no relation to the carbon dioxide production or to the liberation of potassium.

W. S. G.

585. **The Effect of Wood and Wood Pulp Cellulose on Plant Growth.**

VILJOEN, J. A. and FRED, E. B. (University of Wisconsin). *Soil Science*, Vol. XVII, No. 3, pp. 199-211. Plates 3, bibliography. Baltimore, 1924.

In Wisconsin there are large tracts of land formerly covered with forest, but which are now cleared of timber. The prevailing soil type is decidedly acid, and for the first year after cultivation the crop yield is usually unsatisfactory. Investigations were made to study the effect of different kinds of wood on the growth of oats and clover on these cut-over soils.

The experiments showed that the depression in the growth of plants was due to lack of nitrate nitrogen in the soil, the loss of nitrate nitrogen being probably due to increased nitrate assimilation by micro-organisms. The same results can be obtained with wood-pulp cellulose as with wood, hence it does not seem that there is any toxic action on the plant due to such wood constituents, as essential oils, resins and tannins, which in large amounts are toxic, but in these experiments the very small amounts

of these substances derived from the 1 % of added wood could hardly have any appreciable effect on the plant.

Alder and poplar are more injurious than birch or willow, due perhaps to the difference in the rates of decomposition.

As inoculated peas can be grown in the presence of sawdust without showing any ill effects, the injury from wood cannot be due to a poisonous substance. The experiments show that the lack of nitrate is due, rather to a reduction than to an inhibition of nitrification. That nitrification takes place is shown by the fact that with large amounts of bloodmeal in the soil the rate of nitrification can be so increased that it exceeds the rate of reduction and an accumulation of nitrate takes place.

The result of these tests as a whole indicate that the reduced growth of plants following the application of young wood is connected with loss of nitrates. This injurious effect passes off and is hardly appreciable the following season. W. S. G.

586. **The Effect of Nutritive Elements on the Development of Soil Bacteria.**

CHOUCHACK, D. *Comptes rendus de l'Académie des sciences*, Vol. 178, No. 24, pp. 2001-2002. Paris, 1924.

The author states that the development of bacteria can be used as a means of soil analysis, because although these organisms are lower plants, they require nearly the same amount of nutritive elements as plants that are far higher in the scale.

The experiments described by the author in this paper clearly prove the truth of his theory. Increasing the amount of nitrogenous or phosphatic fertilisers has the same effect on the development of bacteria as on the growth of higher plants. The larger quantities of fertiliser applied at first stimulated growth, but in the end a maximum was reached, beyond which all additions were useless or injurious. F. D.

587. **The Application to Soil Analysis of a New Method of Potassium Estimation.**

BULLI, M., FERNANDES, L. and FOA, N. *L'Agricoltura coloniale*, Year XVIII, No. 12, pp. 417-420. Florence, 1924.

BULLI and FERNANDES have already described (*Annali di Chimica applicata*, Year 13, No. 11, p. 46) the method devised by them for the estimation of potassium, and now, in collaboration with FOA, experimented on the application of this method to the determination of the potassium present in the soil. The results obtained proved as accurate as those given by the official chloro-platinum acid method which is far more troublesome and costly.

The operations involved in the new method may be summarised as follows : preparation of the nitric acid solution — calcination — recovery with distilled water and precipitation with lead nitrate — precipitation (by means of sodium nitrite and cobalt nitrate, in the form of cobalt ni-

trite of lead and of potassium) of the potassium in the filtrate — solution of the precipitate with permanganate to which sulphuric acid has been added — the addition of a decinormal solution of sodium oxalate until the permanganate is discoloured and the manganese dioxide is dissolved — testing the excess oxalate with permanganate. F. D.

588. **The Quantitative Determination of Nitrates in Soil.**

WIJK, D. J. R. van (Department of Agriculture, Union of South Africa). *Soil Science*, Vol. XVII, No. 2, pp. 163-179, bibliography. Baltimore, U. S. A., 1924.

The author reviews the many processes devised for the determination of nitrates in soil and points out their respective advantages and disadvantages, finally giving his reasons for the employment of the aluminium reduction process, as described by BURGESS (BURGESS, P. S. The aluminium reduction method as applied to the determination of nitrates in alkali soils. *Univ. Cal. Exp. Agr. Sci.*, Vol. 1, No. 4). The author successfully applied this method, with certain modifications, to the estimation of very small quantities of nitrates, where it was necessary to Nesslerize the ammonia produced. A large number of duplicate estimations were made, as described in the paper, very satisfactory results being obtained.

W. S. G.

589. **Microbiological Analysis of Soil as an Index of Soil Fertility** (1).

I. — WAKSMAN, A. S. and STARKEY, R. L. (New Jersey Experiment Station). Carbon Dioxide Evolution. *Soil Science*, Vol. XVII, No. 2, pp. 141-161, bibliography. Baltimore, U. S. A., 1924.

II. — WAKSMAN, A. S. and HEUKELEKIAN, O. Decomposition of Cellulose. *Soil Science*, Vol. XVIII No. 4, pp. 275-291, bibliography, 1924.

An historical account is given of the work of the investigators who have used the evolution of carbon dioxide as an index of the decomposition of organic matter in the soil. The authors then describe their experiments and the apparatus employed, and the results are summarised as under:

Determination of the amounts of carbon dioxide evolved from soils can be used in grading these soils on the basis of their fertility. The data in this paper and in those published previously on the microbiological analysis of soils, allow of looking forward to the development of a group of quantitative methods for determining the productive capacity of the soil.

The capacity of a soil to produce carbon dioxide may be measured, either by determining the amount formed from one kilogram of fresh soil, in fourteen days, under optimum conditions, or, by determining the amount produced from 500 mgm. of dextrose added to 100 gm. of fresh soil, in forty-eight hours.

The addition of lime to an acid soil stimulated production of carbon dioxide, but not to so great an extent as nitrification. This is due to the

(1) See *R.* 1923, No. 333 and *R.* 1924, No. 11. (*Ed.*)

difference in the nature of the organisms responsible for the chemical changes. The authors continue the work of former investigators, and their experiments indicate that the estimation of the power of a soil to decompose cellulose may be used for carrying out a microbiological analysis of a soil. A study of the nitrification processes showed that information obtained by the this method can serve as a basis for determining the microbiological conditions of a soil, the rapidity with which the soil nitrogen becomes available, as well as the reaction and the buffer content of the soil.

For every milligram of nitrogen that is available or that can become available in the soil, in the given period of time, there will be decomposed 40 to 50 mgm. of cellulose in the given amount of soil.

A study of the cellulose-decomposing power of the soil can thus yield information on soil fertility. This method can supply information on the total nitrogen in the soil as well as on the difference in the activities of the soil micro-organisms.

Three methods are described for the estimation of the cellulose-decomposing power of the soil. W. S. G.

590. **Soil Analysis Based on Bacterial Action.**

CHOUCHACK. D. L'analyse du sol par les bactéries. *Comptes rendus de l'Académie des Sciences*, Vol. 178, No. 22, pp. 1842-1844. Paris, 1924.

Bacteria, like all other living cells, produce a catalase of which the amount can be measured by the volume of oxygen liberated when they are in the presence of oxygenated water. The decomposition of oxygenated water by the soil is partly due to the catalase produced by the micro-organisms which it contains, and partly to the mineral and organic components of the soil itself. It is easy to separate these two actions, for if 1.5 to twice its weight of water is added to the soil and the mixture is heated to boiling point, the catalase is destroyed, and the oxygen set free on the addition of the oxygenated water depends solely upon the catalytic action of the elements that make up the soil. A second experiment carried out with unheated soil would give the amount of oxygen due to the combined action of the micro-organisms and of the soil constituents. The difference between the two figures represents the *biological index* of the soil. Since plant growth depends on bacterial development, the *biological index* affords an easy and rapid means of soil analysis. The author has found by experiment that in the case of land that had been treated in various ways and sown with wheat, the height of the cereal was in proportion to the biological indices. F. D.

Fertilisers and Manures.

591. **Manurial Trials with Super-Phosphate, Basic Slag, " Rhenaniaphosphat " and Dicalcic Phosphate.**

NIKLAS, H., STROBEL, A. and SCHARRER, K. (Agrikulturchemisches Institut der Landw. Hochschule Veihenstephan). Phosphorsäuredüngungsversuche mit Superphosphat, Thomasmehl, " Rhenaniaphosphat " und Dikalziumphosphat

auf vier verschiedenen Bodenarten. *Landwirtschaftliche Jahrbücher*, Vol. LIX, Part 5, pp. 641-672, bibliography of 60 works. Berlin, 1924.

In his comparative manurial tests carried out on 4 different soils and with various plants, the author obtained the best results from the phosphoric acid contained in the superphosphate, though "Rhenaniaphosphat" was nearly as satisfactory; this phosphate was closely followed by the dicalcic phosphate, while the last place was taken by basic slag.

F. D.

592. **The Rehmsdorf Nitrogenous Fertiliser.**

ROVIERA, P. (R. Stazione chimico-agraria, Torino). Sul concime nitrogenato di Rehmsdorf. *Le Stazioni sperimentali agrarie italiane*, Vol. LVII, Parts 1, 2, 3, pp. 77-81, fig. 1. Modena, 1924.

Under the name of "Nitrogenina", or "Concime organico nitrogenato solubile" the A. G. Rehmsdorf Consortium for the manufacture of chemical products has put on the market a fertiliser which, according to the illustrated pamphlet published by the Society, is composed of animal waste (skins, bones, blood etc.) that has been rendered soluble by a special process.

The author found the acidity of the fertiliser (expressed as sulphuric acid), to be 1.22 %; while its composition was as follows: water 8.23 %; water-insoluble components 25.66 %; water-soluble components 66.11 %. The water-insoluble portion contains 3.66 % of compounds soluble in ether, and 3.50 % of organic nitrogen; the water-soluble portion contains 0.16 % of ammoniacal nitrogen, 2.52 % of organic nitrogen and traces of nitric acid. There are 17.69 % of inorganic substances with only traces of phosphoric acid and potash.

The author has studied the efficacy as a fertilizer and the power of decomposition of this compound as compared with dried blood. From his pot experiments with wheat, he concludes that "nitrogenina" is a compound that decomposes readily, but considerably less rapidly than dried blood and hence its fertilising action is slower. F. D.

593. **Sulphur in relation to Soil Fertility.**

POWERS, W. L. (Chief of Department of Soils, Oregon Experiment Station). *Station Bulletin*, No. 190, *Oregon Agricultural College*, pp. 45, figs. 17. Corvallis, Oregon, U. S. A., 1923.

In 1912, the Oregon Experiment Station found that the increase in yield of alfafa obtained by the use of potassium sulphate was equal to that when acid phosphate was applied.

Tests showed that on more than twenty arid and semi-arid soil types of Oregon, the yield of 100,000 acres of alfafa could be increased by one ton or more per acre with sulphur, at a cost of abut 1 dollar per acre per annum. Legumes generally responded to sulphur applications, also wheat and potatoes, but there was little increase in the case of peas, beans, maize, kale, rape, and sunflowers. The protein content of crops was found to be increased. Lysimiter studies show that 40-45 lb. of sulphur is lost in the annual percolate.

Sulphur seems to be related to nitrogen supply. Water culture and pot experiments indicate that sulphur is an especially necessary element, although a small amount only is necessary.

Applications up to 1000 lb. per acre have resulted in continued marked increased in yield. The use of sulphur beyond the amount needed to replace deficiency tends to increase soil acidity in humid and semi-humid regions, and its continued use will make liming more necessary. A combination of sulphur, rock phosphate, farm manure and lime has given the maximum yields. W. S. G.

594. **Bacterial Soil Fertilisers.**

I. — MAKRINOFF, I. A. Experiments with Bacterial Soil Fertilising Preparations. *Soil Science*, vol. XVI, No. 1, pp. 19-29, figs. 4, bibliography. Baltimore, U. S. A., 1924.

II. — IDEM. Is it possible to make a Bacterial Soil Preparation for Non-Legume Crops? *Ibidem*, pp. 31-38, 6 figs., bibliography.

I. — The author alludes to work carried out in Germany, Holland, Denmark and other countries and discusses the preparations, " Nitragin ", " Nitroculture ", " Nitrobacterin " and " Azotogen ", and describes experiments made to ascertain the causes of failure of bacterial fertilisers. As a result of inoculation, increases were obtained in the weight of roots of infected plants, the number of nodules on the roots, and also in crop yields. The greatest success was obtained in the experiments in which alkaline fertilisers were used, such as basic slag or lime. Nitrate of soda reduced or suppressed the nitrogen fixing capacity of the organisms.

It was concluded from these experiments that a properly prepared inoculant properly applied to a soil kept in a condition suitable for the development of these organisms, will be beneficial from the standpoint of inoculation. The necessary conditions are: a mellow soil, sufficient moisture and well selected fertilisers. If these precautions are taken, soil inoculation may be practised on a large scale under field conditions.

II. — A description is given of the work of the former investigators, including more recent research carried out by STOKLASA, BOTTOMLEY, LIPMAN and others. The author's experiments are described and it is stated that the work is being continued on a large scale and the results will be published in the near future.

It was concluded that bacterial inoculation and soil cultivation and fertilisation must not only strictly correspond to the needs of the plants, but also to the physiological requirements of the micro-organism employed W. S. G.

Agricultural Botany

595. **The Effect upon Plants of a Prolonged Stay in High Altitudes.**

BOUGET, J. De l'influence sur les végétaux d'un séjour prolongé à haute altitude. *Comptes Rendus de l'Académie des Sciences*, Vol. 178, No. 21, pp. 1748-1751. Paris, 1924.

A description of experiments carried out from 1901 to 1924 on *Narcissus Pseudo-Narcissus* and *Iris xyphoides* at the Botanical Garden of the

Pic du Midi Observatory and in the neighbourhood of Bagnères-de-Bigorre. It was found that a progressive deterioration took place during 15 years in the case of a plant growing wild at 800 m. which had been transplanted to a height of 2860 m.

At the end of the fifteenth year, the plant had reached such a weak condition that it was on the point of perishing; it was, however completely restored to health by being moved first to an altitude of 1900 m. (where it remained for one year) and then kept for four years at an altitude of 800 m. F. D.

596. **"Auximones" and the Growth of the Green Plant.**

CLARK, N. A. and ROLLER, E. M. (Iowa State College). *Soil Science*, Vol. XVII, No. 3, pp. 193-198. Baltimore, Md., 1924.

The nutrition of the green plant has generally been regarded as satisfied by a supply of inorganic food materials, from which organic material is produced and the complete plant structure built up. Recently, however, this conception has been questioned by BOTTOMLEY, and MOCKERIDGE, who have stated that in addition, very small quantities of growth-promoting organic substances are absolutely essential. To these substances BOTTOMLEY gave the name of *auximones*, and it was suggested that their function was similar to the accessory factors termed vitamines, necessary for the growth of animals.

The authors carried out experiments to investigate these growth-producing substances; in one instance *Lemna major* was grown for more than twenty generations without auximones, and reproduced normally and the plants showed no signs of falling off.

As a result of their studies the authors concluded that the growth of *Lemna major* in mineral solutions depends upon suitable concentration of salts, and that organic matter is not necessary. Also, the suggestion that auximones act as essential constituents in the growth of plants, in the same way as vitamines for animals, must be negatived. The question whether organic matter will function as an accelerator when the solution is adapted to the plants' needs is receiving further study. W. S. G.

597. **Colloidal Properties of Winter Wheat Plants in Relation to Frost Resistance.**

NEWTON, R. (University of Alberta, Edmonton, Canada). *Journal of Agricultural Science*, Vol XIV, Part 2, pp 178-191, Plate 1, figs. 2, bibliography. Cambridge, 1924.

The author has previously noted that wheat plants in their winter-hardened condition retain their water content with great force, the significance of which lies in the fact that the first effect of freezing plant tissues is the withdrawal of water from the cells to form ice in the intercellular spaces. From the standpoint of frost resistance, forces opposing this desiccation must therefore be of great importance.

The hydrophilic properties of the colloidal pentosans and their function in the economy of certain drought-hardy plants, led to the conjecture that these pentosans probably accumulated in the cells during the hardening process induced by the falling temperature in the late autumn, and contributed to the formation of a protoplasmic gel of high inhibitional powers.

The results of the investigations have established that certain colloidal properties of winter wheat plants are closely related to frost resistance, and provide indices of hardiness which may have practical application in the breeding and selection of hardy varieties.

The inhibition pressure of fresh leaves, in winter-hardened condition, was found in most cases to be directly related to hardiness.

The volume of press-juice obtained per 100 gm. of hardened leaves was inversely proportional to the hardiness of the variety.

The quantity of hydrophylic colloids contained in the press-juice, as measured by an effect on the movement of water, was found to be directly proportional to hardiness. W. S. G.

598. **Fluctuating Variations in Soy Bean.**

LEITH, B. D. *Journal of the American Society of Agronomy*, Vol. 16, No. 2, pp. 104-108, tables 5. Geneva, N. Y. 1924.

Since 1911 the author has made a special study of the soy bean from the point of view of percentage oil content, drying index, productive capacity of certain strains of beans, and protein content.

Although no variation in chemical composition was evident (except in the case of change of environment) inherited fluctuations were observed as regards oil content (14.1 to 19.8 %) and protein content (35 to 44 %) and iodine number (124 to 146). Only within rather wide limits have they been consistent in a certain direction between varieties of a single year. M. L. Y.

599. **The Effect of Radiant Heat on the Plant Cell.**

BORDIER, H. Influence de la diathermie sur la cellule végétale. *Comptes rendus de l'Académie des Sciences*, Vol. 178, No. 22, pp. 1844-1847. Paris, 1924.

When the oscillations of high frequency currents pass through damp soil of average density, the action of the current is shown by a delay in cell-multiplication in the seeds in the ground. The rise of temperature accompanying the passage of the current does not contribute to this result. F. D.

600. **The Effect of Röntgen Rays upon the Germination of *Oryza sativa* (1).**

KOMURO, H. *The Botanical Magazine*, Vol. XXXVIII, No. 445, pp. 2-20, tables 15, bibliography. Tokyo, 1924.

Report of Experiments made in Tokyo (Japan) to test the practical utility of Röntgen rays in agriculture. According to the results obtained

(1) See *R.* 1922. No. 543. (*Ed.*)

with numerous germination tests, it may be concluded that in the earlier stages of growth, seeds containing much water are stimulated by the rays and germination is accelerated. The effect was even more noticeable in the case of air-dried seeds especially with the 5 H-10 H dose (1). Plants from seed irradiated after 12 hours steeping were inferior to those from seeds X-rayed in the air-dried condition.

The acceleration of germination varies with the current and hour of application in a definite tube. M. L. Y.

Plant Breeding.

601. **Effects of Selection on the Yield of a Cross between Varieties of Maize.**

RICHEY, F. H. (Agronomist in Charge of Corn Investigations, Bureau of Plant Industry). *Bulletin No. 1209* p. 19, tables 4. United States Department of Agriculture. Washington, D. C., 1924.

The productiveness of first-generation corn (maize) crosses and their parent varieties has been compared from time to time. In the varietal experiment at Armorel, Arkansas, in 1915, the one outstanding strain was the F_1 of the cross Whatley × Sir Charles White. This yielded 81.9 bushels of air-dry, shelled maize per acre, in comparison with 72.4 bushels of U. S. Selection No. 77. Sir Charles WHITE the staminate parent yielded 67 bushels.

The author continued these experiments, and again the cross, Whatley × Sir Charles White was markedly more productive than the average of its parents.

Open-fertilised mass selection was ineffective in maintaining this high productiveness, but the method of crossing followed by mass selection has established a variety of economic value.

Strains have been isolated by selection within self fertilised lines which when intercrossed have produced as much as the original F_1 varietal cross; but whether these crosses can repeat remains to be proved. W. S. G.

602. **Rice Selection in Indo-China.**

Sélection du riz en Indo-Chine. *Cahiers coloniaux de l'Institut colonial de Marseille*, No. 268, p. 122. Marseilles, 1924.

Rice is far the most important product of Indo-China and in good years the surplus available for export may be as much as 1 500 000 tons in the case of Cochin-China, and 280 000 tons in that of Tonkin.

This rice, although possessed of excellent nutritive qualities and good chemical composition, is classed low on the markets of the world on account of its unattractive appearance which is due to the small grains that vary in shape and size and sometimes even in colour.

(1) H = Holzknecht's unit.

For some time past efforts have been made in Indo-China to remedy this defect in the native rice and to obtain consignments of well sorted seed that will produce homogeneous grain of the same type. At Tonkin, where labour is abundant and cheap, the authorities have tried to popularise the use of the CERTANI sorting tables. In Cochin-China a Genetic Institute has been created which is trying to obtain pure lines of a carefully-selected type.

This latter method can claim to be based on the most scientific principles but it would be many years before it could supply the rice growers with the very large quantities of selected seed required for sowing the millions of hectares under rice. The Genetic Institute was only able to supply the growers with 100 tons of seed-rice for 1924.

It therefore seemed desirable to the Society of Distilleries of Indo-China, the chief factory of which can hull 500 tons of paddy a-day, to adopt a method giving certain results as regards the homogeneity of the rice and the yield per hectare, and therefore a source of immediate improvement in the product although it cannot claim to obtain pure lines.

With a view to a practical industrial demonstration, the Society has therefore installed in its factory at Hanoi a complete plant for the mechanical sorting of rice-seed, in which 400 kg. can be treated per hour.

The rough paddy is taken into a shed which is completely separated from the factory in order to avoid any chance of its being mixed with the other rice ; it is then poured into a hopper whence it is carried by an endless belt to the first elevator which drops it into the cleaner. As soon as the rice is clean, it is taken by means of a second elevator to a flat rocking-sieve with graduated slits. The sieve has 3 sheet-iron plates with holes of different sizes which allows 4 classes of rice, including the waste, to be separated. The selected paddy is taken up by a third elevator and thrown into an endless screw that carries it into 2 honey-comb sorting-drums where the grain is classified according to length. The paddy, after this sifting, has been selected for its thickness and length and now passes on to be classified according to its density. The heaviest grain collects at the bottom of the shaking table and falls into the fourth elevator which carries it to the final cleaner where all the dust produced during the various operations is removed.

In the course of the work, samples are taken of each class obtained and the weight per litre is estimated. A few seeds are chosen from each sample and put to germinate when they have been soaked for 2 days at 30° C. ; after 4 days in the malt-house the proportion of seeds that have germinated is calculated.

This apparatus was used for demonstration purposes at the fair at Hanoi. From one test, the following results were obtained. The density of the paddy treated was 0.640 and its germinating capacity was 47 %. After treatment, the density was 0.692 and the power of germination had risen to 89 %. On another occasion, the density rose from 0.630 to 0.681, and the germination capacity from 64 % to 89 %. The refuse consisted of light paddy husks and dust.

The satisfactory results obtained from these experiments induced the

Governor of Cochin-China, Dr. COGNACQ, to buy a similar plant for the Colony which has been installed at Cholon, the centre of the rice trade (1).

F. D.

603. **Study of Correlation in the Groundnut.**

NEVANO, G. Studio di alcune correlazioni nell'arachide. *Le Stazioni sperimentali agrarie italiane*, Vol. LVII, Parts 1, 2, 3, pp. 17-33, bibliography. Modena, 1924.

The author concludes from the results of his exhaustive investigations that the best way of improving the groundnut (*Arachis hypogaea*) is to choose the plants bearing the largest number of seed pods without taking into consideration their weight, or the size and number of the nuts. Whereas, the exact correlation between the weight of the dry pods and their total number is very close ($r = 0.874 \pm 0.007$), the correlations between the weight of the dry pods and their average unit weight, and between the weight of the dry pods and the number of nuts to the pod are by no means so close, being $r = 0.384 \pm 0.026$ in the one case, and $r = 0.218 \pm 0.029$ in the other.

There is however, a close correlation ($r = 0.704 \pm 0.011$) between the weight of the dry pods and the weight of the plant with the fruits attached at the time it is lifted. A similar close correlation exists ($r = 0.610 \pm 0.019$), between the weight of the dry pods and that of the plant without its pods at the time it is lifted. Hence the yield could be increased by choosing the heaviest plants, whether the weight of the pods is included or not. By the first method a closer correlation is obtained and the operation is also easier and quicker.

F. D.

604. **Self-Fertilization in *Nicotiana*.**

ANDERSON A. and SMITH F. F. (Missouri Botanical Garden, St. Louis), *Science*, N. S., Vol. LIX, No. 1534, p. 501. New York, 1924.

Since self-sterility (according to EAST) is due to the fact that pollen tubes after self-pollination show no acceleration in growth and hence fail to reach the ovary before the decay of the flower, the authors considered that, if unopened buds were self-pollinated, additional time would be gained, and the pollen tubes might reach the ovary before the flower decayed. In several instances, pollinations were simultaneously made on the unopened bud, the first (apical, that is youngest) and the second flowers on the same branch of the panicle of both *Nicotiana alata* plants and hybrids between *N. alata* and *N. Forgetiana*. Seeds were set in 68 per cent. of the pollinations of unopened buds, whereas in the first flowers, seeds were set in only 16 per cent. of the cases and there were none set in the second flowers. This indicates that the gametes are not incompatible, and that self-fertilization can take place in *Nicotiana* provided the male gamete can reach the egg.

F. D.

(1) See *R.* 1924, No. 36 (*Ed.*)

605. **Researches on the Vitality of the Pollen of certain Fruit-Trees.**

MANARESI, A. (R. Scuola superiore di agraria, Bologna). Ricerche sulla longevità del polline di alcune piante da frutta. *Le Stazioni sperimentali agrarie italiane*, Vol. LVII, Parts 1, 2, 3, pp. 33-55, bibliography of 20 works. Modena, 1924.

The extensive experiments made by the author are of great practical value to fruit growers in connection with artificial cross-pollination.

The results of these experiments have proved the following facts amongst others.

The length of time during which pollen retains its fertilising power differs according to the variety and the species of plant.

The pollen of the apple, pear, peach, cherry, plum, mirabelle plum and vine retains its power of germination better and longer in very dry surroundings, for instance in a dessiccator with calcium chloride, than when it is in the open air. Pollen that is kept in a similar extremely dry place only loses about half of its initial viability and is therefore in good condition after the following number of days: apple, 143-183; pear, 97-127; peach, 69-104; cherry, 83-126; plum, 127-169; myrabolan, 130; American vines (*Vitis rupestris* and *V. riparia*) and several of their hybrids, 46-86; European vines, a few days.

If on the other hand, the pollen is left in the open air, its germinating capacity only remains satisfactory for the following number of days: apple, 32-48; pear, 22-27; peach, about 21; cherry, maximum 51; plum, less than 48; myrabolan, less than 51, American vines and their hybrids, less than 22; European vines, less than 17. F. D.

Seeds.

606. **Seed Selection in Canada.**

STEVENSON, T. M. Technique of Field Husbandry: Laying out an Experimental Field and Breeding Nursery. *Scientific Agriculture*. Vol. IV, No. 2, pp. 42-54, bibliography. Ottawa, 1923.

The author reviews the growth and development of experimental work in Canada and the most advisable methods for laying out an experimental field. Details are given of the plan adopted at Saskatoon and the numbering system by which the blocks are readily located. Following this is given a description of the two most common methods employed in laying out a breeding nursery:— the Centgener method (i. e. the hundred seed small plot border series) and the "head-row" method limited to twenty seeds from each selected cross. The "ear row" method is used for maize, and only part of the seed planted from each ear. Selections from the first year's crop are made but are placed on reserve and the remnants of the selected rows from the previous year are used in the second year. A similar method is adopted in succeeding years.

The above methods are adapted especially to cereals and the author quotes certain modifications as advisable for biennial and perennial crops.

The "Champlin" system of classification according to size of unit and

kind of crop is fully described, a system first started at the South Dakota Experimental Station and now in use at Saskatchewan.

Where various sizes in plots are being made this system has proved valuable and saves both time and trouble, besides lessening the possibility of error in calculation of yields, etc. The writing up of projects, annual reports, field books etc. is simplified to a considerable extend.

A discussion is included as to the effect of the shape of the seed plot on seedlings. The long rectangular plot is recommended to overcome the inconvenience of soil heterogeneity, etc.

The necessity of considering the effect of borders around seed plots is noted. The effect will vary under different conditions and with different varieties, but the removal of at least the outside border rows from each plot is considered necessary.

The advantages and disadvantages of check plots compared with the replication system are discussed. The former is considered preferable from the point of view of amount of work done in the same amount of land as compared with the replication of plots. The latter has advantages as regards calculation.

In conclusion, the author refers to the question of machinery and the danger of mixing seed, obviated to a large extent by hand selection. Reference is made to the type of plough, seeder, cultivator, binder and threshing machine found to be the most satisfactory.

M. L. Y.

607. **Lesage's Method Unsuitable for the Rapid Determination of the Germinating Power of Rice Seed** (1).

Borasio, L. Circa i metodi per la determinazione rapida della facoltà germinativa dei semi. *Il Giornale di Risicoltura*, Vol. XIV, No. 5, pp. 84-85. Vercelli, 1924.

The author, in the experiments which he conducted at the Chemical Laboratory of the Vercelli Experiment Station of Rice-Growing, has tested the method proposed by P. Lesage (*Comptes rendus de l'Académie des Sciences*, No. 11, pp. 756-762, Paris, 1922), for the rapid determination of the power of germination. According to Lesage, seeds that are capable of germinating impart a yellow colour to 2^{-5} normal solutions of potash in 4 hours, whereas seeds which have lost their vitality, colour much more dilute normal solutions up to the limit of $\frac{1}{2}\ 2^{-5}$.

In the authors' experiments, seeds that were incapable of germination coloured $^1/_{200}$ and $^1/_{100}$ N. solutions of caustic potash and soda, while the seeds of the highest germinating capacity coloured the less dilute solutions. Thus Lesage's method evidently cannot be applied to rice.

F. D.

(1) For the unsuitability of this method also in the case of beet-seed, see *I. B.* 1924, No. 342 (*Ed.*)

608. **Superiority of Seed of Local Production.**

BIANCHI, C. Per una maggiore e più razionale produzione di " Semenzine ". *L'Avvenire agricolo*, Year II, Series II, No. 4, pp. 121-125. Parma, 1924.

The superiority of locally-grown seeds in their native environment has been clearly shown by the experiments recently conducted by Dr. BRESAOLA of the Lodi Agrarian Consortium (1921-1922) and by the Seed Office of the Cremona Agrarian Consortium. The results obtained from the Lodi tests are given in the following table. As a rule, lucerne is grown for 4 years and clover for 2 years.

Comparative Trials of Forage Crops obtained from Seed of Different Origins.

Origin of seed	Yield of Forage in Quintals per Hectare		
	1921	1922	Total
Lucerne:			
Perugina	474	138	612
Siena	598	593	1 191
Bologna	466	177	643
Urbino	570	270	840
Fermo	495	228	723
Local	**763**	**934**	**1 697**
Ravenna	517	171	688
Local	**703**	**874**	**1 577**
Clover:			
England	764	311	1 075
Ivrea	539	323	862
Local	**753**	**484**	**1 237**
Bologna	576	118	694
Local	**655**	**447**	**1 102**
England	560	77	637
France	635	99	734
Florence	535	30	575
Local	**785**	**555**	**1 338**

The superiority shown above is explained by the fact that the impure varieties of the plants cultivated are composed of various types or forms with different characters and requiring different environmental conditions. With repeated cultivation, the forms that find the conditions suitable or that are most adaptable ultimately prevail. Thus a natural selection takes place by means of which in any given zone, after a longer or shorter series of crops, the seed consists of a collection of the types which are best able to resist any adverse conditions of their surroundings, and are hence most productive in that particular environment.

F. D.

609. **Production of the Seed of *Lotus corniculatus*.**

DE ROTHSCHILD H. Production de la graine de lotier corniculé. *Comptes-rendus de l'Académie d'Agriculture de France*, Vol. X, No. 1, pp. 134-137. Paris, 1924.

In 1920 the author reported (1) the importance of *Lotus corniculatus* as a forage plant for soils of low or average fertility. In this article, he deals with the production of the seed of this Leguminosa.

The seeds at present on the market give rise to growths differing greatly in appearance, productivity and date of ripening. The plants flower and reach maturity at different times, and as the fruit opens very easily, much seed is lost. In order to avoid this difficulty, it is necessary to have recourse to pedigree selection. At Vaulx-de-Cernay, 360 kg of seed per hectare were obtained from the second cut, the first cut having been used for forage. F. D.

610. **Seed Potatoes with High Solanin Content.**

SCHOWALTER, E. and HARTMANN, W. Über Kartoffeln mit hohem Solaningehalt. *Zeitschrift für Untersuchung der Nahrungs- und Genussmittel*, Vol. 47, Part 4, pp. 257-257. Münster, 1924.

There were many cases of high solanin content in the potatoes harvested in 1922 in Germany. The authors however proved, by means of their experiments conducted at the "Staatliche Untersuchungsanstalt" of Erlangen, that these abonrmal potatoes do very well for seed and produce normal tubers. F. D.

611. **Delinting and Recleaning Cottonseed for Planting Purposes.**

BARR, J. E. *United States Department of Agriculture, Bulletin* No. 1219, pp. 1-19 ,figs. 8, plates 8. Washington, D. C. 1924.

These investigations include a series of tests conducted for the purpose of determining the effect of delinting at varying rates of cut on the percentage of seeds injured by the saws, the appearance of the seeds, germination, planting capacity, and weight per bushel.

The advantages of delinting are shown ; the process accelerates germination, allows the removal of 100-150 lb. of lint per ton of seed without injury, reduces both the weight of seed and volume of cottonseed per unit of weight and increases the weight per bushel.

It is estimated that the cost of delinted and recleaned seed per ton as a basis for determining the selling price may be computed by adding the cost of delinting and recleaning to the original cost or value per ton of the ginned seed, deducting the market value of the linters and seed removed, multiplying the remainder by 2000 and dividing the product by the number of pounds of recleaned seed obtained from a ton.

The author has made special studies with regard to the cost of the operations of delinting and recleaning, showing the interdependence of the two processes in producing the highest grade product. M. L. Y.

(1) See *B.* 1920, No. 748 (*Ed.*)

CROPS IN TEMPERATE AND TROPICAL COUNTRIES

Cereals and Forage Crops.

612. **Wheat Production in Southern Europe.**

JOVINO S. Il clima e l'uomo nella produzione granaria meridionale. *Giornale di Agricoltura della Domenica*, Year XXXIV, No. 23, p. 208. Piacenza, 1924.

In order clearly to show the extent to which climate is responsible for the low wheat production characterising the southern countries of Europe, the author gives the following particulars :

According to ADRIAN DE GASPARINO, the wheat growing region where relatively certain crops can be counted upon, lies between 40° and 50° of latitude. As an excellent instance of this area the Departments lying between the English Channel and Paris may be taken. For a comparison between the unit production of this zone and that of a district representing the conditions obtaining in Southern Europe, for instance, in Basilicata, it is necessary that the cultural methods should be the same. This difficulty can however be partly eliminated if the crops obtained in a favourable season only are compared, since the effect of cultivation methods on grain production is least marked when the weather is good. In the above-mentioned zones, the unit production is respectively 48 and 30 quintals per hectare ; hence the ratio (48 — 30); 48 or in round numbers — 0.4 represents the *relative climatic depression.*

In other words, the climate of Basilicata and of all semi-arid Southern Italy exercises a climatic depression of 40 % on local wheat production as compared with the optimum climate of Northern France.

On comparing North Italy with Basilicata, a climatic depression of (40 — 30) : 40, viz., of 20 % is also found.

From a series of observations and experimental data obtained in Ionian Basilicata where the climate is hot and semi-arid (1), the author draws the following conclusions :

1) The crop preceding wheat has a considerable effect upon the grain yield, in as much as deep ploughing, the application of manure, the early breaking up of meadows, pastures and green fallows land, and the granular condition of the top spit are all excellent means of preventing injury from drought ; 2) the action of chemical phosphatic fertilisers is certainly good in the case of soil that has been well ploughed at the right time ; 3) on such land and on bare fallows, the direct application of phosphatic-nitrogenous fertilisers has proved the best and most economical treatment for wheat ; 4) in the case of wheat following pasture, a nitrogenous fertiliser applied in the autumn has no result and its effect is doubtful

(1) S. JOVINO, *Se e come possa e debba prosperare la granicoltura nell'arido Mezzogiorno.* Cattedra ambulante di Agricoltura, Potenza, 1924.

if applied in the spring ; 5) the use of chemical fertilisers reduces on an average the cost of wheat production by about one-third ; the increased grain yield was about 4-6 quintals per hectare ; the increases in the net returns were 270-300 lire per hectare ; 6) the great trouble of the wheat-grower in Southern Europe is not lack of rain but the extreme virulence of rust ; 7) wheat is a plant with a great capacity for drought resistance and is therefore indispensable in the rotations of the agriculturist of Southern Europe.

F. D.

613. **A Classification and Detailed Description of the more Important Wheats of Australia** (1).

Seed Improvement Committee (Secretary, E. ARCHER). *Bulletin No. 26 Institute of Science and Industry, Commonwealth of Australia*, pp. 72, plates 5 + tables. Melbourne, 1923.

A comprehensive classification and description, drawn up on lines similar to those already published (2) but containing, in addition, data regarding the characteristics of many varieties grown under widely dissimilar soil and climatic conditions, with notes on their economic possibilities. A total of 82 varieties is described, based on the records obtained from the different States and careful observations made as to the characteristic height, stooling property and time required for ripening.

M. L. Y.

614. **Comparative Results with South African Seed Maize Varieties tested in the United States.**

PAPENDORF, E. A. *The Farmers' Weekly*, Vol. XXVII, N° 682, p. 261. Bloemfontein, 1924.

Experiments have been made at the Arlington Experimental Farm, Virginia (U. S.) and further trials will be carried out at the University of Utah, Salt Lake City (U. S.) with samples of South African seed maize, and the results as regards acclimatisation and the comparative effect on vitality and seed bearing capacity are of undoubted interest.

The most successful results were obtained with Salisbury White which gave 83.2 bus. per acre (average yield per row 4659 bus.) and a shelling percentage of 88. This compares very favourably with the good quality American " Boone County " white dent variety which was grown simultaneously and gave 76.9 bus. per acre ; shelling percentage 83.9. Next in order comes " Ladysmith Pearl " with 67.4 bus. per acre, and " Potchefstroom Pearl " with 65.4 bus.

The most unsatisfactory results were obtained with " Hickory King " with only 30 bus. per acre and a shrinkage of 36 %.

(1) See *R.* 1923, n° 642. (*Ed.*)

(2) " Classification and detailed Description of Barley and Oats in Australia ", see *R.* 1923, No. 195. (*Ed.*)

The table shows comparative yields of fifteen different varieties tested at Arlington. M. L. Y.

615. **Comparative Value of Ensiling and Drying Soft Maize.**

EVVARD, J. M., LAMB, A. R. and MAYWAR, D. E. J. Ensiling versus drying soft ear corn. *Agricultural Experiment Station, Iowa, Bulletin* No. 216, pp. 403-432, tables XVIII, figs. 3. Ames, Iowa, 1923.

Report of experiments made at the Iowa Agricultural Experiment Station in order to determine : 1) the advantages of ensiling soft ear maize of different grades ; 2) the comparative advantages as regards palatability, presence of moulds, odours, physical condition, quality, colour and general appearance of resulting products ; 3) effects on composition and total dry matter ; 4) gain or loss of water, calculated on the bases of natural soft ear maize before adding water in ensiling ; and on the cut soft ear maize plus water which was added in the silo ; 5) chemical changes occurring from the time the soft ear is put into the silo until the time it is removed, compared with the ordinary air-drying process. M. L. Y.

616. **The Evaluation of Maize Silage.**

PEARSON, F. A. and GAINES, W. L. *Journal of the American Society of Agronomy*, Vol. 16, No. 4, tables 2, bibliography. Geneva, N. Y., 1924.

A detailed discussion as to the relative values of two methods of evaluating maize silage: 1) cost accounting ; = value of the crop in the field at the time of harvest, cost of harvest and storage, etc. ; 2) nutritional method ; based on digestible nutrients contained in the feeds expressed in terms of shelled maize and hay, and the market values of these feeds.

The first method is illustrated with data collected from 68 Illinois farms and the second method depends upon the averages of the published analyses of maize silage M. L. Y.

617. **Grain Sorghums, Cereals worth testing in Italy.**

CALVINO, I sorghi da granella come cereale da mettere alla prova in Italia. *L'Agricoltura coloniale*, Year XVII, No. 12, pp. 425-427. Florence 1924.

The author advises that grain sorghum, and especially the early varieties derived from " doora " (*Andropogon Sorghum*), should be grown in those districts of Italy where the soil is too arid and poor for the cultivation of wheat and maize. Several varieties of sorghum have been selected, during the last twenty years, for the dry and semi-arid regions of the south-west of the United States.

In Cuba, the red laterite soils that have been exhausted by continuous and unscientifie cultivation are set apart for milo, a forage and grain sorghum, producing a first cut of forage followed by a good grain crop.

Of the various kinds of dwarf sorghum tested by the author at the Cuba Agricultural Station, " Dwarf Hegari ", gave the best results. The author recommends this variety also for dry, poor soils in Italy.

" Dwarf Hegari " is derived from " doora " seeds sent under the name of Hegari by the Inspector of Agriculture at Khartum to the Department of Agriculture of Washington in 1908. Prof. A. B. Conner carried out the selection work at the Texas Agricultural Experiment Station. The dwarf variety is 90-150 cm. high; it is early and possesses thick, short culms, and semi-compact ears about 20 cm. in length, and some 7 cm. in diameter. The ripe seeds are white, spotted with red and brown.

When sown in Cuba, on September 9, this sorghum was harvested on November 24, i.e., in 76 days, the spring sowing of May 22 was harvested on August 22, i. e., 90 days.

White sorghums furnish a richer flour than wheat flour, for which it may be substituted in bread-making in proportions of 25-30 %.

F. D.

618. **Experiments in Heating the Water of Rice-Fields.**

Astorri G. Il riscaldamento dell'acqua in risaia: le prime esperienze. *Giornale di Agricoltura della Domenica*, Year XXXIV, No. 24, p. 2-13, figs. 4. Piacenza, 1924.

The Italian rice-fields are situated on the extreme northern limit of rice-cultivation, therefore few of the many tropical varieties can be grown. Some varieties of rice from the United States and Japan which ripen in 120 days in those countries have been found by experiment to require 5 or 6 months to reach maturity at Vercelli. In the rice-growing zone traversed by the network of electric wires where discharges of energy could be produced at small cost, it might be 'possible to heat, with very little expense the water of the seed plots which represent $^1/_{12}$ of the area under rice when the seedlings are transplanted. Experiments have been begun at the Vercelli Risicultural Experiment Station, the apparatus used being that ordinarily employed for transforming electric force into thermic energy. In the case of sowings made on May 1, 1924, the figures obtained on May 20th were: heated rice-plot, aerial parts of plants 11 cm., roots 5 cm., unheated rice-plot, 5-6 cm. and 3 cm. respectively.

It is thus clear that after 20 days, the seedlings in the heated nursery are ready for transplanting, while those in the unheated nursery take about 45 days to reach the same stage. Heating the water would enable transplanting to be carried out in the middle of May, *i. e.* at a time when labour is plentiful, and any danger of killing the seedlings by late frosts, is avoided. The consumption of energy was about 6 500 kilowatt-hours per hectare of rice field actually cultivated.

F. D.

619. **Winter Hardiness of Medium Red Clover Strains.**

Arny, A. C. *Journal of the American Society of Agronomy*, Vol. 16 N° II, Tables 2, bibliography, Geneva, N. Y., 1924.

A series of experiments have been made under the direction of the U. S. Department of Agriculture to test the comparative winter resistant qualities of red clover strains introduced from various parts of the world.

The results may be summarized as follows :

1. In Minnesota, medium red clover seed coming from the North Central States gave uniformly low percentages of plants destroyed through low temperatures and averaged good yields of hay in both first and second cuttings.

2. Seed from the Western States (Oregon) and the Central East (Tennessee) did not give as uniformly satisfactory results as those from the North.

3. Strains from Northern Europe were not so resistant as the Northern States' strains, although a sufficient proportion of vigorous plants remained and gave good yields. Results with strains from Australia were more variable.

4. Strains from France, Chile and Italy, suffered to the extent of 81 %, 89.5 % and 93.8 % respectively and no measurable yields of hay were obtained.

It should be noted, however, that there was a good snow covering in the States where these strains were tested and further proofs are necessary to confirm the comparative values.

The author concludes that native northern grown seed is probably more profitable for the United States farmer, although the foregoing results serve as a useful basis for further work with the acclimatisation of leguminous crops. M. L. Y.

620. **Root Development of Lucerne under Varying Conditions of Water Supply and Fertiliser.**

DAVIS, B. M. *New Zealand Journal of Agriculture*, Vol. XXVIII, N° 3, p. 179-180. Wellington, 1924.

Experiments were made by the author at Canterbury University College on a sandy loam under greenhouse conditions, with the object of ascertaining the effects of application of superphosphate on lucerne roots. The plants were divided into three sections receiving 15 inches, 30 in. and 60 in. of rainfall per annum respectively. In each case control plots receiving no fertiliser were established. All plants were examined, 4, 8 and 20 weeks after germination. The results may be summarised as follows :

1. The depth of penetration of the main tap-root was less in the case of plants receiving fertiliser than in those receiving none. This applies to plants receiving 30 in. and 60 in. of rain, but the contrary for those receiving 15 in.

2. The laterals and the tap-root were of a somewhat less diameter in plants receiving superphosphate than on the control plots. No regular difference was observed as regards relative diameters of cortex and conducting tissues.

3. There was an increased amount of root developed in the surface soil when fertiliser was used. The reverse was observed for the 20 week plant.

4. Superphosphate did not result in an increase in the total root

production, but exercised a depressing effect when combined with heavy or light rainfall.

5. The efficiency of the roots judged from the "nutritive efficiency index" with 30 in. rain was not altered by an application of superphosphate, but was considerably so in the case of 15 in. and 60 in. and to approximately the same extent in both cases. This was especially noticeable when the fertiliser was used.

A measure of the relative efficiency of the roots may be obtained by dividing the weight of the foliage produced by the total length of root laterals.

6. Superphosphate adversely affected the germination of the seed.

M. L. Y.

621. **Lucerne Associated with Wheat Cultivated as a Hoed Crop.**

POGGI, T. Tecnica frumentaria. *Il Coltivatore*, Year 70, No. 15, pp. 457-458. Casale Monferrato, 1924.

The School of Practical Agriculture at Pescia (Province of Lucca), has solved the problem of cultivating wheat as a hoed crop with lucerne growing in between. The wheat is hoed and moulded up early in order that the moulding-up process may be finished in March, and the lucerne is sowed in the furrows that have been produced by the moulding up. The lucerne comes up well, and after the wheat has been harvested and at the stubble cut, a fine field of lucerne growing in strips has already been obtained. Hoeing is done transversely, i. e., perpendicularly to the strips; in this way, the ground is levelled and the lucerne is moulded-up; which makes the crop grow vigorously so that it quickly covers the whole surface.

F. D.

622. **Lucerne as a Protection against Fire.**

GREENWOOD, F. W. *New Zealand Journal of Agriculture*, Vol. XXVIII, No. 2, p. 103. Wellington, 1924.

The value of lucerne as a fire-break was strikingly demonstrated at Marlborough (New Zealand) quite recently. The wind carried the fire directly toward the *Danthona* grassland but thanks to the intervention of a lucerne field it was possible to keep the fire under control. In drier districts where grass-fires are liable to occur, the establishment of protection belts of lucerne is well worth the consideration of the farmers.

M. L. Y.

623. **Lupin Cultivation and its Advantages.**

I. — Versammlung zur Hebung des Lupinbaues. *Mitteilungen Deutschen Landwirtschafts-Gesellschaft*, Part 10, 1924, pp. 161-162. Berlin, 1924.

II. — MÜNGBERG (Tierzuchtinspektor) Sortenbau. Düngungs und Beizversuche mit Lupinen. *Ibidem*, Part 16, pp. 300-302. Berlin, 1924.

I. — In February 1924, a Conference was held at Berlin at which the advantages of cultivating lupins and the possibility of extending the area

under this crop formed the subject of discussion. The opinions expressed by a few of the speakers on this occasion are here quoted.

Dr Bensing (Danzig) referred to recent experiments in the cultivation and selection of lupins and stated that these plants can be cultivated, not only on sandy soils, but also on richer soils, where also they produce heavier yields. Any risk of failure owing to the nature of the crop can be prevented by a careful selection of the varieties. There are a large number of local varieties which should be studied with reference to different conditions, and the choice of appropriate methods of cultivation, autumn ploughing, little working of the soil in spring so as to preserve the soil moisture, early and copious seeding.

The production of lupins of low alkaloid content by means of selection is a matter of great importance. The question of the rapid extension of lupin growing depends entirely upon selection. There exists an enormous number of varieties that have arisen from crossing, spontaneous mutations and hybridisation. The cultivation of lupin varieties with low alkaloid content has shown that this character is not always fixed. This is a point which could be systematically studied when more information has been obtained respecting the nature of the poison, the methods of determining the amount present and the relations existing between the alkaloid and the albuminous matter.

Dr Zorner (Neu Racoczi) afterwards discussed how far a deficiency in albuminous substances could be economically combated by growing lupins, which suit all animals and are of conspicuous food value for they supply a forage with a high protein content. They are also an economical crop, as is seen by comparing the yields of oats and lupins and the relative cost of cultivation.

The advantages of harrowing at the time of sowing and the necessity for more exhaustive researches on the thickness of seeding etc. were other matters upon which much stress was laid during the Conference.

II. — After enumerating all the good points of the lupin (very high albuminoid content, power of enriching the soil for the benefit of the succeeding crop, heavy yields obtainable on poor, sandy soils), the author lays stress on the fact that the best method of preventing the plant, which is very susceptible to bad weather, suffering from low temperatures, is to sow early so as to insure an early harvest.

Special efforts have been made to create new varieties and select early, hardy and highly productive local varieties. As an instance of what has already been done in this direction, mention may be made of the cultural experiments conducted with different varieties in 1923. April was chosen as the best month for sowing ; the seeds were sown at a depth of 2.5 cm. to 3 cm. and at the rate of 120 to 130 kg. per hectare, light sowings being made of the yellow varieties and heavier sowings of the blue.

Lupins sown at the beginning of April take 20-25 days to come up, but if the seed is planted at the commencement of May, it germinates in 7-9 days. Flowering begins as a rule about July, the yellow varieties and the white Belbe variety flower later and sometimes do not reach

maturity. The crop is harvested from the middle of August to the beginning of September.

The yields obtained, together with the names of the experiment stations, the nature of the soil and sub-soil and the preceding crop are given in a table.

As regards seed-yield, the red Merkel lupin clearly ranks first. It is followed in order of merit by the blue Röemer lupin, the blue local lupin, the white Kofahl lupin and the yellow Belbe variety.

As an instance of the crops produced, reference may be made to the red Merkel lupin high yield of 31.61 quintals per hectare at Weihanstephan when sown after spring barley, while 24.629 quintals per hectare were obtained from blue Silesian " Handelsaat " planted on a light soil with permeable sub-soil and following potatoes.

In addition to possessing the defects above referred to, lupins often grow slowly after the formation of the 4th leaf. Hence a suitable fertiliser should then be applied to increase the vigour of the plants. Manurial experiments have been made with potash, phosphoric acid and nitrogenous fertilisers ; a summary of the results are set forth in a table similar to the preceding table. These experiments prove the great importance of potassic salts. On the other hand, favourable results were only obtained in one case with phosphoric acid. The explanation is to be found in the fact that owing to the acids secreted by their roots, lupins have a great power of assimilating the soil phosphates. Therefore, phosphatic fertilisers should only be used for very poor soils. It was also found by experiment, that the inoculation of the lupin seeds with active root-bacteria is more satisfactory and less expensive than the application of nitrogenous fertilisers. Such inoculation should always be practised on new soils and soils upon which lupins are seldom cultivated.

The treatment of seed with a view to protecting plants from cryptogamic diseases has also received considerable attention of late years.

The compounds used for this purpose, which have generally a mercury basis, not only destroy fungi, but also increase the yield by stimulating the lupins. The results obtained with these compounds are, however, very variable as the author shows in a table. The character of the soil appears to have much effect on this stimulating action. Further experiments are still in progress. R. D

624. Soya as a Forage Plant for Dry Countries.

Stigliano N. Osservazioni e considerazioni su la coltivazione della soia come pianta foraggera nel Mezzogiorno. *Rivista di Zootecnia*, Year 1, No. 3, pp. 69-74, figs. 4. Portici, 1924.

The author has grown soya experimentally in the R. Istituto Zootecnico of Bella (Province of Potenza) at an altitude of 450 m. The plant was sown on May after beans and following on ploughing to a depth of 20 cm. ; it was harvested from the beginning of August to the middle of September, the seeds proving to be a mixture of 4 different

varieties ; twenty crops were obtained without manuring, inoculation, or any special cultivation operations.

The plant succeeded well, although during the 4 months of its vegetation no rain fell. As its seeds are dehiscent, they sow themselves and thus reconstitute the meadow.

From these results the author concludes that soya can be cultivated as a forage crop in South Italy without interfering with the ordinary crops or rotations, for it only occupies the ground for a period during which no other herbaceous plant can, as a rule, be counted upon for a certain crop. He therefore strongly advises the extended cultivation of soya, not only as forage, but also as a pulse crop. F. D.

625. **Korean Lespedeza a Valuable Forage Crop.**

Science, Vol. LIX, No. 1829 p. XV (Supplement). Lancaster, Pa. 1924.

A new plant known as Korean lespedeza has recently been introduced into the United States and is likely to prove a valuable forage crop. This species resembles to a large extent the Japanese lespedeza, but whereas the latter dislikes long summer days and does not produce seed much further North than the Ohio river, the Korean variety on the contrary seeds well in the North. It thrives well and should be of much economic importance. M. L. Y.

626. **Elephant Grass in Brazil.**

Sobre o capim elephant. *Chacaras e Quintaes*, Vol. 29, No. 3, pp. 232-233. São Paulo, 1924.

The experiment of growing elephant grass (*Pennisetum purpureum* Schum ; syn. *P. Benthamii* Sten.), in the " Estãçâo Esperimental de Agrostologia " has been very successful, for the plant proved of very rapid growth, while it adapted itself to the most different soils, provided they were dry. Dr. C. Spitz of the above Station has made two analyses, one of plants 2 m. high (7 weeks after the first cut and before the flowers appear), and the other of plants 1.20 m. in height. He obtained the following percentages from the first analysis : water 85 — crude ash 1.39 — crude protein 1.37 — ether extract 0.28 — crude fibre 4.61 — N-free extract 7.35. The figures resulting from the second analysis were respectively 92.5 — 1.23 — 1.52 — 0.20 — 1.77 and 2.78 %.

The plant when fully grown attains the height of 4 m., but it is then woody. F. D.

627. ***Acacia giraffae*, a Useful Drought Resistant Fodder Plant in South Africa.**

Verdoorn, I. C. *Journal of the Department of Agriculture. Union of South Africa*, Vol. VIII, No. 4, pp. 414-416, plates 1. Pretoria, 1924.

The leguminous plant " Kameeldoorm " (*Acacia giraffae*) is found in the sandy regions in the northern part of the Cape Province, on the basalts of the Transvaal, in Bechuanaland and in South West Africa.

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The whole pods may be ground to a fine meal, which is very palatable to stock, but should be fed after milking and not before, as the flavour is to a certain extent transmitted to the milk.

An analysis has shown the following composition :—

	Water %	Crude protein %	Fat %	Crude fibre %	Ash %	Carbohydrates %
Husks	3.54	8.84	0.96	30.69	7.05	48.92
Seeds	17.46	28.81	7.95	12.88	4.08	41.82

The fact that *A. giraffae* is a drought resistant plant requiring little cultural attention should be noted. The young seedlings will not establish themselves in dense shade. The trees are often found in groups owing to the fact that suckers are abundant.

According to the reports of the Forest Department the heartwood, which alone is valuable for timber, only appears to develop when the tree has reached a considerable age. The sapwood rots quickly, and the tree can therefore be used solely for firewood. M. L. Y.

Industrial Crops.

628. **Cotton in French West Africa and Togo.**

I. — *Replies to the Cotton Questionnaires of the International Institute*, with the most recent data available from the various colonies.

II. — Communications from His Excellency the Administrator of the Mandated Territory of Togo (French), dated 1 June and 1 September 1923.

III. — Emanuel PELLERAY, *Notre Domaine Colonial V.* L'Afrique Occidentale française (Paris 1923), p. 24 and p. 96. *Mission Bélime*, « Les Irrigations du Niger 1921 et 1923 », p. 124. Le Togo.

IV. — *Institut Colonial de Marseille. Les Cahiers Coloniaux*, No. 217, 23 February 1923, p. 409; No. 269, 3 March 1924, p. 140 and No. 282, 2 June 1924, pp. 341 to 350.

V. — RIGAULT, P. La solution urgente du problème cotonnier et la mise en valeur du Soudan français. *Bulletin de la Société d'encouragement pour l'Industrie nationale*, Year 123, Vol. 136, No. 2, pp. 146-156. Paris, 1924.

VI. — DYBOWSKI, J. Sur la culture du coton dans l'Afrique occidentale française. *Comptes Rendus de l'Académie d'Agriculture de France*, Vol. X, No. 9, pp. 321-325. Paris, 1924.

VII. — *The Cotton Growing Countries*, International Institute of Agriculture. Rome, 1922.

I-IV. — This dependency of France comprises a number of adjacent territories, differing among themselves in climate and character of vegetation and also not less in the types of population which include several separate native races.

The aggregate area is about 3,740 thousand square kilometres. Of this immense surface, the Territory of the Niger covers some 1,200 thousand and the French Soudan (also aligned with the River Niger) accounts for another 900 thousand, while Mauretania comprises some 400 thousand

square kilometres. About two-thirds of French West Africa are, therefore, included in these two colonies, for the most part very sparsely inhabited, excepting in some districts of the river valleys. The remaining areas, in all about 1200 thousand square kilometres, are within the colonies of the Senegal, French Guinea, Ivory Coast, Dahomey and Haute-Volta. The mandated territory of Togo does not, strictly speaking, form part of the region known as French West Africa, but is treated in the same volume by M. PELLERAY; it adjoins Dahomey and has some special importance as a cotton grower, so that its 52 thousand square kilometres may be considered in conjunction with the neighbouring territories, for the present purpose.

The centrally placed dominion of French Equatorial Africa has large possibilities as regards commercial cotton growing, but in the absence of transport facilities from the remote shores of Lake Tchad, this great extent of territory must be considered as outside the scope of the present essay.

Cotton has been cultivated during a very long period in the French Soudan, in Senegal, in Central and Northern Dahomey and in the upper districts of the Ivory Coast Colony.

The natives have always woven it for their own garments and the cultivation was, on several occasions officially encouraged by successive conquerors in the Soudan. When it became a matter of some importance to utilize and to amplify existing sources of cotton supply, the French Government took the question in hand; the suitability of considerable areas in these regions was expected to allow the development of cotton production with the ready aid of the natives on a sufficient scale. The experience gained by experiment on this basis, was however, unfavourable; as regards any great development of production, the indolence of the black races was an insurmountable obstacle, the tendency being always to limit the yields entirely or almost entirely to their own needs.

Even in the case of groundnut cultivation, which requires but little labour, the same difficulty was encountered. Cotton growing demands much greater assiduity than groundnut cultivation, if it is to be made a commercial success by providing for export requirements.

The indigenous cotton plant is a perennial and very prolific. The crop results are, however, poor, as the bolls are small, while the uneven character and frequent shortness of staple are also serious drawbacks.

It is true nevertheless, that the indigenous cotton of Dahomey and the Ivory Coast Hinterland has merits of its own. The lint is very white, and some spinners appreciate it highly. A letter from Belfort (France) addressed to the *Académie d'Agriculture* and published in *Cahiers Coloniaux* of 3 March 1924, p. 140 expresses the view of an expert in the following terms.

" It is stated that Dahomey, without irrigation, produces only harsh, rough cotton which does not please spinners except for fabrics of mixed cotton and wool. I have used Dahomey cotton for many years and have succeeded in obtaining yarn of a quality surpassing that produced from ordinary American cotton. The Dahomey staple is somewhat rough,

but has both length and strength. My experience of African cotton is in favour of the unirrigated cultivation in Dahomey of selected native cotton, not hybridized, in preference to irrigated exotic strains. I am of the opinion that it would be well to discourage the importation into Dahomey of American seed, which might militate against production of the natural and satisfactory qualities of native cotton".

In No. 282 of *Cahiers Coloniaux* (2 June 1924, pp. 342, 343) it appears from the circular of 15 March 1924, issued by the Governor General of French West Africa, that the procedure just mentioned is recommended officially, and that the facts are substantially as stated from Belfort.

The Governor General adds that the indicated selection of type is practicable only where the native takes an interest in obtaining good results from his crop. At present agriculture is very elementary in many parts of West Africa; the plough is not used, a small hoe being employed, capable only of surface work. Efforts are in progress in some districts towards bringing into use all practicable improvements, but the Governor General does not seem very hopeful of any immediate results in Dahomey or the Ivory Coast Colony. At present, with the small size of the boll, and the low yields of lint in ginning, the production of cotton is not more than 30 or 40 pounds per acre. Transport is nearly all by porterage so that the expenditure of time and labour in carrying cotton to a market must be a formidable item in the cost of production. The Governor General recognizes that the extension of cotton growing in such circumstances can only be effected by persistent official encouragement; the natives already obtain quite sufficient cotton for their domestic requirements, and are accustomed to ginning and weaving for themselves, making common cloths of 3½ to 4 yards in length; sometimes these cloths change hands as local currency, but are not usually offered for sale at any market. The Governor does not encourage the continuance of experiments with American seed in Dahomey, as former trials have had no permanent success.

The mandated territory of Togo, which adjoins Dahomey, has experienced a series of developments in cotton growing that are unique. Under German rule, experiments in cotton production were not, at first successful. The Administration began the work with negro managers brought over from the United States: these peoples soon found that the methods which they had always employed were quite inapplicable in Togo; information schools were then opened, but also proved a failure, as the pupils would not carry on cotton growing when they returned to their villages. It was only in 1912 that the School became an experiment farm, and work was begun with *Gossypium barbadense* (Sea Island) cotton, carefully followed up by selection of seed among the improved experimental plants. The exports up to 1914 were chiefly of native cotton, and averaged about 1100 thousand pounds annually, while just before the war the Sea Island crop came into use. This type has been persistent in the territory, but as no new strain of seed was developed during the war, gradual hybridization with native cotton plants was inevitable, and Togo Sea Island cotton has an average staple of about 1 ½ inches, as compared with West Indian Sea Island of nearly 2 inches. The German Imperial Government appears

to have aimed at the establishment of fine exotic cotton in Togo, and eight ginneries were built by them in different localities. In 1921, the French Administration inaugurated a new experiment farm and in 1923 a control was established enforcing a strict selection of all cotton brought to market. Planting takes place in June, the cotton is in flower in September, and picking begins in December,

The effect of control on carefulness in the gathering is noticeable. The view is held that the use of motors for ploughing, as well as transport, is the most practical method of extending cotton growing in Togo : labour is not plentiful, and the tsetse fly render the employment of cattle almost impossible.

About 20 per cent of the whole crop is said to be the quantity utilized for weaving by the natives themselves according to the estimates furnished by the Administration. The high prices of European textiles, rendered unavoidable by the dearness of cotton, gives a considerable impetus to local cloth manufacture in the villages. For the greater part of the information on Togo, acknowledgments are due to His Excellency the Administrator of the Territory.

The foregoing details have been devoted to cotton growing in the territories under French rule in the Gulf of Guinea, and reference may now be made to the valleys of the Upper Niger and Upper Senegal Rivers, known as the French Soudan.

Here the problem is stated concisely in the circular of the Governor General of French West Africa, of 15 March 1924 and already mentioned. His Excellency remarks as follows :

" It is a matter of the deepest interest to ascertain the practicable extent to which irrigation can be utilized for cotton growing in the Great African Valleys."

In Nigerian lands, cotton is everywhere to be seen where vegetation flourishes. There is plenty of heat for its growth, but to the northward the rainfall is often deficient, and becomes almost non-existent as the Sahara desert is approached.

All along the river valley irrigation would be a great boon. One of the principal conclusions reached by M. BÉLIME, Director of Public Works, in French West Africa deals with the possibility of adapting the Niger seasonal floods to the requirements of cotton growing, by means of irrigation works at certain points on the course of the river. M. BÉLIME has gained practical experience in the Niger Valley during a number of years and, apart from projects of development in that region, has also made preparations for carrying out works of a similar character on the Senegal River.

Some particulars as to progress already made may be of interest at this point.

Les Cahiers Coloniaux of 20 February 1923 reports an address given by M. Marcel HIRSCH, Director of the " Compagnie de Cultivation cotonnière du Niger " to colonial members of the Chamber of Deputies. He said that the number of workers employed by the Company on the land was then 2515 ; the Company had to experiment at first by planting, in 1921, 150

acres with cotton, but it was in October and too late in the year, and the result was only 15 tons of seed cotton. In 1922, 1250 acres were planted in March and this proved to be too early, but 150 tons of seed cotton were obtained; in 1923, nearly 4000 acres were planted and the yield expected was 600 tons for seed cotton, or about 400 thousand pounds of lint. He hoped to go on doubling the area year by year, so that by 1930 there would be a considerable crop. The Institute is now informed by the Government of the French Soudan that 75,000 acres are under cotton in that colony, and that the total yield 1923 was 1200 tons (2640 thousand pounds) of lint. This includes the plantations of other companies as well as those of the Niger Company, and may possibly cover native crops also. The Niger Company has locations at Diré, near Timbuctoo, at Sama and elsewhere.

To return to the important circular of 15 March 1924, the Governor General announces the inauguration of a " Service des textiles " for French West Africa. This Service will proceed to investigate the best methods for the production of cotton intended to aid in supplying the requirements of France. Preparations for the installation of hydraulic apparatus and other irrigation measures are specially contemplated. The Service will have control of the experiment and selection farms for all investigations dealing with textile production, and of the inspection of textiles intended for export. Ginneries, which are now very few in number, and cotton presses are to be established in the French Soudan, in the Haute-Volta, in the Ivory Coast hinterland and in French Guinea. In the native cotton districts, experiment farms of 500 acres each are to be set up for the training of foremen and other skilled workers as cotton specialists, and for the selection of the most promising varieties and the consequent distribution of suitable seed.

American cotton seed will not be introduced afresh into Dahomey, the Ivory Coast and Guinea, but will be encouraged in the Soudan and the Haute-Volta, as the native cotton grown in these two colonies is considered to be defective in some attributes, and a judicious selection of American and Egyptian varieties may be of great advantage. The high cost of transport, even by rail, from the Niger Valley to the West Coast ports renders it most advisable to concentrate on production of good qualities, since the charges on low priced cotton are almost prohibitive, except when cotton is dear and scarce.

It may be remarked that the proposed irrigation works on the Niger and Senegal rivers would be of untold benefit to the population, quite apart from any question of cotton crops. An adequate and constant supply of water would transform a semi-arid region into an extremely fertile province, where famine or even scarcity might be ended for generations to come.

V. — The area in French West Africa, which is best adapted to cotton growing covers the whole of the Upper Senegal and the Upper Niger as far as Timbuctoo and in particular the district included between the river and its tributary, the Bani, on the right bank. The produce of this region can easily find an outlet by the river routes and the two railways by which it is connected with the ports of Dakar and Konackry on the Atlantic.

The public authorities are anxious to exploit this district and have prepared an elaborate scheme for the adaptation of the Valley of the Upper Niger for purposes of growing cotton by irrigation methods, but the work would take thirty years to accomplish and this is considered too long.

M. RIGAUL is of opinion that irrigation is not suitable for the whole of the area. Comparisons with conditions prevailing in Egypt, where there is hardly any rainfall, are misleading : up the river from Sausanding on the Niger over the whole district to the S. W. of the town and between the Niger and the Bani there is a rainfall of 750 mm. annually, which is practically sufficient for the native varieties of the cotton-plant. Below Sausanding the rainfall is less but the deficiency can be made good by watering and the use of the pumps, a system which is easily and rapidly established. Watering is already successfully employed upon the area granted to the " Société de culture cotonnière du Niger " at Diré near Timbuctoo.

In the author's view, to obtain a speedy result, it is necessary to continue the dry cultivation method for the cotton-growing, but at the same time to introduce improvements as regards yield and quality. Such improvements can be obtained within five to seven years if attention is paid to the following points :

(1) Individual selection of the local varieties ; (2) the crossing of local varieties with early American varieties ; (3) the establishment of a Service for phytopathology, entomology, disease prevention and fumigation.

VI. — The " Académie d'Agriculture de France " decided at its meeting on the 30th January 1924 to call upon its section for special crops to summon a Commission to advise as to the steps, which in its opinion should be taken, to secure that as soon as possible the French Colonies should produce all the cotton required for the national industry.

Exports of Cotton (lint) from French West Africa and Togo

(in thousand pounds)

Years	from Dahomey	from the Ivory Coast	from Senegal	from the French Soudan	from Togo
1914	297	162	—	—	—
1915	151	209	—	—	—
1916	219	788	—	—	755
1917	226	326	—	—	1 004
1918	775	957	—	—	578
1919	295	731	50	—	1 281
1920	319	459	54	34	781
1921	924	135	134	47	1 584
1922	—	156	210	69	1 496
1923	—	546	671	308	1 688

The Commission met on the 13th February 1924, when the following conclusions were reached and adopted by the meeting :

(1) The method of cultivation without irrigation is of real value in existing conditions and at present prices, and should receive all possible

encouragement in those areas where the rainfall is sufficient to ensure a good growth of cotton.

[4] According to the present state of knowledge of the question, the irrigation method of cultivation appears in all the circumstances to be the process best adapted to secure for French trade the amount of raw material required.

Some data of exports in ginned cotton (lint) are given above.

J. H. H.

629. **Cotton Culture.**

TAYLOR, H. W. (Tobacco and Cotton Expert). *Bulletin* No. 466, Department of Agriculture, Rhodesia, pp. 15, plates 2. Salisbury, Rhodesia, 1924.

The bulletin draws attention to the annual decrease in the carry over of cotton, due chiefly to the reduction in the American output. Mention is made of the various parts of the British Empire in which cotton may be introduced, or more extensively grown.

A detailed description is given of the climate and soil required for the crop, soil cultivation, seed selection, planting, thinning, picking and preparation for market.

W. S. G.

630. **Cotton Growing in the United States.**

BAILLEUX, G. La Culture du Coton aux Etats-Unis. *Bulletin Agricole du Congo Belge*. Vol. XIV, Nos. 2-3, pp. 215-359, figs. 105, tables 3, bibliography. Brussels, 1923.

As a result of special investigations, the author presents a complete survey of the cotton situation in the United States. This descriptive work includes observations on classification, distribution, climate, soil, manures, rotation, cultural operations, yield, economic questions, diseases and pests, selection, ginning, pressing, packing, trade standards and the use of by-products.

M. L. Y.

631. **Cotton Cultivation in Madagascar.**

REYNIER (Chef du Service de l'hydraulique agricole). La Culture du coton. Rapport de tournée dans l'Ouest et le Sud-Ouest. *Madagascar et Dépendances. Bulletin* of 3rd and 4th Quarters of 1923, pp. 159-173, map. 1 Tananarive, 1923.

The author gives a complete account of his mission. His report is divided under the following heads: object of mission, itinerary, conditions of economic cotton growing, observations made in course of journey, deductions from these observations, character of experiments to be made, areas suitable for planting with cotton, labour.

R. D.

632. **Wild Fibre-producing Plants and the Spinning Industry in South Africa.**

MACLAGAN, R. F. *The South African Journal of Industries*, Vol. VII, No. 4, pp. 303-210. Pretoria, 1924.

Over 30 different types of fibre producing plants have been found growing wild in South Africa, but hitherto the spinning value has not been extensively developed and many have been overlooked commercially.

The author confines his description to those better known and which offer definite commercial prospects viz. *Hibiscus Cannabinus*, *Cannabinus sativa*, *Linum usitatissimum*, *Phormium tenax*, *Furcraea* and *Agave sisalana*. In each case details are given as to distribution, production and yield, and market value, and full cultivation details are given with reference to sisal and furcraea (soil, fertilisers, planting, harvesting and cutting, decorticating), including an estimate based on average conditions of the capital required and the probable profits from a plantation of 2000 acres. This can be briefly summarised as follows : Capital £30.000 ; total profit in 10 years £75 000 ; total average 25 % per annum or 15 % after allowing a return of capital over 10 years. Observations are made on the cordage spinning industry associated with furcraea and sisal.

As regards the market value of the types discussed, the figures given refer to the import value at the United Kingdom ports. *Hibscus* £21 - 10 s. per ton c. i. f. ; *Cannabinus* £66 per ton ; *Linum*, L. 90 per ton ; *Phormium*, L. 32 per ton ; *Sisal* and *Furcraea*, £30 per ton.

Amongst the other useful wild fibre plants mentioned as common in Natal and Zululand are included the following:— *Abutilon indicum*, *Corchorus triloculans*, *Dais cotinifolia*, *Comphocarpus physocarpus*, *Grewia caffra*, *Hibiscus gossypinus*, *H. physaloides*, *H. Sabdariffa*, *Lasiosiphon amthylloides*, *L. macropetalus*, *L. meisnerianus*, *Pavonia columella*, *P. macrophylla*, *Peddiea africana*, *Sida capensis*, *S. carpinifolia*, *S. cordifolia*, *S. rhombifolia*, *Syncolostemon densiflorus*, *Triumfetta effusa*, *Tr. pilosa*, *Tr. rhomboidea* and *Urena tenax*.

M. L. Y.

633. **Oleiferous Plants of Indo-China.**

CREVOST, Ch. Catalogue des produits de l'Indochine. Matières grasses, oléagineuses (huiles concrètes ou de consistence inconnue). *Bulletin économique de l'Indochine*, Year 27, No. 164, pp. 37-77, figs. Hanoi, 1924.

A study of the following plants of Indo-China that yield solid oils or oils of unknown consistency. The author gives their area of growth, method of cultivation, yields, various uses, etc.

Cashew-nut, *Anacardium occidentale*, *Barringtonia speciosa* and *B. racemosa*, *Carapa moluccensis*, *Celastrus paniculata*, Chaulmoogra (*Hydnocarpus anthelminthica*), *Gynocardia odorata*, *Taraktogenos Kurzii*, Cocopalm (*Cocos nucifera*), Oil palm (*Elaeis guineensis*), *Hernandia ovigera*, Deccan hemp (*Hibiscus cannabinus*), *Lindera tonkinensis*, *Bassia Pasquieri*, *Bassia edulis*,

Irvingia malayana and *I. Oliveri*, *Pittosporum pentandrum*, Mangosteen (*Garcinia Mangostana*), Persian lilac (*Melia azedarach*), Nutmeg (*Myristica glaucescens*), Rambosteen (*Nephelium lappaceum* and *N. mutabile*), Niepa bark (*Samadera indica*), Kamala (*Mallotus barbatus*), *Sterculia foetida*, *S. pexa*, Tamerindo (*Tamarindus indica*), Chinese tallow-tree (*Stillingia sebifera*), *Triadica cochin-chinensis*, *Pongamia glabra*, Gamboge (*Garcinia cambodensis*), *Horsphieldia irya*, *Erodia fraxinifolia*, *Litsea sebifera*, Soapnut tree (*Sapindus Mukorossi*), *Sterculia hychnophora*. R. D.

634. **Cultural Conditions and Productivity of the Olive.**

S. PETRI, L. Alcune considerazioni sul rapporto fra condizioni colturali e produttività dell'olivo. *Le stazioni Sperimentali Agrarie italiane*, Vol. LVI, Parts 1-2-3, pp. 145-151. Modena, 1923.

Two theories have been suggested to account for partial or total sterility in olive-trees: (1) that the olive is pleomorphic as regards flower distribution, some trees bearing monoclinic flowers with normally-developed stamens and pistils, others producing staminiferous flowers with more or less reduced pistils, while a third class of tree bears both monoclinic and staminiferous flowers. If this distribution of the flowers is due to ontogeny, the phenomenon is wholly independent of any external circumstances that may affect the growth of the tree. Hence if an olive-tree is sterile because all or a majority of its flowers are staminiferous, the only course for the grower is to graft upon it scions taken from other trees producing normal pistillate flowers.

(2) the second theory denies the existence of the above three classes of trees, but attributes the sterility to the relatively early arrested development of the ovary, a phenomenon what occurs without distinction in the case of all olive-trees whether wild or cultivated, and independently of their good or bad vegetative conditions.

The number of flowers that are sterile from insufficient development of the pistil varies according to the individual and the variety and even in the same tree under different nutritive conditions.

The author brings foward the following facts in support of this second theory: (1) the exclusive production of staminiferous flowers can be induced by lessening the transpiration current, or by removing all the leaves from the flower-bearing branches as soon as the floral buds unfold, or by exposing young trees in pots to prolonged drought; (2) the distribution of monoclinic and sterile flowers respectively on the same tree and on the same branch reveals the connection between the transpiration current and ovule development. Thus the smallest number of staminiferous flowers is invariably found on the highest branches and the ovule is normally developed in the terminal flowers of the inflorescences and at the end of the small branches; (3) an excessive production of sterile flowers occurs chiefly in southern regions with long periods of drought, but where the soil is sufficiently supplied with water, even in the summer, the proportion between monoclinic and staminiferous flowers normally remains above 1; (4) staminiferous flowers occur on the same plant in maximum numbers

that alternate during periods of unequal length; (5) neglected olive-trees that have become sterile can be restored to productivity by systematic and continued working of the soil combined with pruning and manuring (1).

F. D.

635. **The Effect of Associated Crops on the Productivity of the Coconut Palm.**

CORREIRA AFONSO P. Plantações mixtas e o seu efeito na produtividade. *Oultramar*, Year 65, Nos. 4109, 4111, 4112, 4113. Margae (Portuguese India), 1924.

It is rare to find in Portuguese India plantations of coconut palm which are not associated with various fruit trees of medium or large size :— Mango (*Mangifera indica*), Jack tree (*Artocarpus integrifolia*), *Spondias mangifera, Thespesia populnea, Odina Wodieri*, Banyan (*Ficus indica*), *Ficus Benjamina, F. retusa, F. glomerata*, Cashew nut (*Anacardium occidentale*), etc.

The opinion is generally held that apart from the profit given by these species, their planting between the lines increases the production of the coconut palms to which they act as shelter trees; they also drain the soil by their roots and serve as a defence against the attacks of pests and parasites.

The author discusses this opinion on the evidence of crop accounts covering long periods for plantations, which are partly promiscuous and partly of palms only and of an inquiry made by him with the principal owners of palms at Goa.

In the light of the data collected he concludes by discouraging promiscuous cultivation, which not only has none of the advantages attributed to it but has also several disadvantages :— obstruction to tillage, manuring, green manuring; the soil always shaded, with the consequence that the surface is always damp and the palms form superficial roots, which renders them less fitted to stand the dry season; greater liability to diseases; late bearing.

Between the rows of cocoanut palm annual herbaceous crops, or crops which occupy the ground for a part of the year only, may be grown; but not tree crops; such is also the opinion of numerous competent persons from the Jesuit Father who wrote the "*Arte palmarica, por um Padre de Companhia de Jesus*", probably about 1783 (the work was published for the first time by the "Imprensa Nacional" in 1841) to H. C. SAMPON (*The Coconut Palm, The Science and Practice of Coconut Cultivation* 1923); C. W. BARRETT (*Coconut Culture*); E. B. COPELAND (*The Coconut*).

F. D.

(1) See F. BRACCI, *I lavori di riforma e di ricostituzione degli oliveti*, Spoleto, 1922. (*Ed.*)

636. **Description of an Oil Palm Plantation in Gaboon.**

VECTEN, M. (Planter in Gaboon). Devis d'exploitation du palmier à huile au Gabon. *Bulletin des Matières grasses de l'Institut Colonial de Marseille*, No. 1, pp. 10-23. Marseilles, 1924.

The author gives a complete account of making an oil-palm plantation in Gaboon and of the financial aspect. His paper is divided under the following heads: method of working the plantation, systematic cultivation of selected individuals of *Elaeis guinensis* with cover-crops of cacao or coffee, the industrial preparation of neutral palm-oil. R. D.

637 **Oil from Seed of *Aleurites* spp. and *Salvia plebeia* in India.**

PARKER, R. N., RAU, M. G., ROBERTSON, W. A., and SIMONSEN, J. L. *The Indian Forest Records*, Vol. X. Pt. II. pp. 1-16, + 1 plate. Delhi, 1924.

Owing to the misunderstanding which has arisen with regard to the occurrence of *Aleurites* spp. in India and Burma, commonly known as the "tung" oil tree, a special enquiry has recently been made to ascertain the true distribution. According to the Range officers' report *A. Montana* grows best near water and the maximum altitude is about 1500 ft. *A. Fordii* is more adapted to a higher range of elevation, and should prove more suitable for general cultivation throughout most of the Southern Shan States (Burma). Both species are at present very rare in India and Burma, but offer no difficulties as to cultivation.

The authors refer to the confusion which has been made with the two distinct species of Chinese origin., *A. Montana* and *A. Fordii* from which the wood-oil of commerce is obtained, and a third species from S. Japan *A. Cordata* R. Br. A definite distinction is here made both as regards morphological characteristics and chemical composition of the oil; the oils differ in the nature of the fatty acids present in the form of glycerides.

Oil from seeds of "Salvia plebeia":— A description is given of the semi-drying oil present in the seeds of the small shrub *S. plebeia* to the extent of 11 % therefore unsuitable for commercial exploitation. The oils present are glycerides of stearic, oleic, and linoleic acids. M. L. Y.

638. **The Adulteration of Senegal Groundnuts by the Admixture of Baobab Seeds.**

CHEVALIER, A. (Directeur du Laboratoire d'Agronomie Coloniale). Sur l'adulteration des arachides du Sénégal par les graines de baobab. *Bulletin des Matières Grasses de l'Institut Colonial de Marseille*, Nos. 11 and 12, pp. 402-403. Marseilles, 1923.

Consignments of groundnuts in their shells are frequently found to be mixed with seeds of the baobab (*Adansonia digitata*). In order to check this adulteration, the author suggests that these seeds should be bought separately. The baobab, a tree that is very common in Senegal and also in the Sudan, has many uses: rope is made from the bark which grows again after stripping like the cortex of the cork-oak; the leaves

are an excellent vegetable ; the fruit pulp is delicious, white, acid and floury, while the seeds contain 12.6 % of fat and have a pleasant flavour when roasted, so that they find a ready market for confectionery. The seeds of *Adansonia grandidieri*, a species of baobab growing plentifully on the West coast of Madagascar, are larger than those of *Ad. digitata* and contain as much as 60 % of fat. R. D.

639. **Tapping Systems from the Point of View of Latex Production.**

BENDIXSEN, E. *The Tropical Agriculturist*, Vol. LXII, No. 3, pp. 135-144. Peradinya, 1924.

The rubber content in latex of untapped *Hevea* trees varies from 35 to 60 % and is seldom under 40 %. The content is almost constant for the individual tree, and it may be assumed that after a group of latex vessels has been fully developed from the cambium, the production of rubber is reduced to the quantity necessary to maintain the equilibrium in the system. The tapping cut followed by a flow of latex causes the tree to produce new latex, which it will continue to do until equilibrium has again been reached ; hence it is clear that tapping must influence the physiological life of the tree considerably.

The author gives data respecting yield from different methods of tapping, and summarises some of the points to be remembered when choosing a tapping system :

1) Every day tapping gives the cells no rest ; hence the number of cuts per inch ought not be carried to extremes. A consumption of 18-22 inches of bark is about normal.

2) Alternate day tapping on half the circunference is a milder system than every day tapping on ¼.

3) If consumption of bark is taking place at a faster rate than renewal, it would be better to change to every other day tapping, than to introduce a new cut.

4) A short cut puts a heavier strain on the cells than a longer cut.

5) A " V " cut continued for 40 inches vertically puts a smaller demand on the cells than a ¼ cut 20 inches vertically. The amount of rubber obtained over a period of 4 years is about the same in each case.

6) If tapping systems are compared, it is important to keep the same number of cuts per inch for each system, and the number of cuts per inch ought always to be recorded.

7) The tapping cut should always be started at the highest point of the tapping surface, and brought down to the ground, before a new surface is started.

8) In order to prevent the spoiling of a tapping surface neither the length of the tapping cut nor its direction should be changed, nor should a system of new cuts be started until a new surface is opened.

9) The alteration of the tapping cut requires great care on the part of the management. The alteration is more difficult to carry through without doing damage, than to alter a system from every day tapping to every

other day, or to exclude the bad yielders from the tapping round. The latter precaution can never do harm, but alteration of the tapping cut may result in harm which may take years to overcome. W. S. G.

640. **Rubber from the Cactus, *Polonus Cider*.**

Indian Scientific Agriculturist, Vol. 4, No. 9 p. 336. Calcutta, 1923.

According to the reports received from Cassi in Havana (Cuba), the Cacti *Polonus Cider* Benth should be of decided value in the rubber industry.

This plant, of Jamaica origin, grown in any type of soil, can be tapped after three months when it reaches the height of 4 ft. The juice flows freely and in density and colour might easily be mistaken for rubber latex. When steamed, it thickens and assumes the gummy consistency of crude rubber, and is of superior quality.

This rubber can be vulcanised and can be employed for all the industrial purposes for which rubber is used. The adaptability of this cactus to marshy, heavy, light or sandy soils is a great advantage, combined with the rapidity of growth. After 1 year, the plants attain a size of 8 ft. × 3 ft. and it is estimated to obtain 2 gallons of juice per plant without injury, which should give about 10 lb. pure rubber. The ultimate height of the plant is about 20 ft. M. L. Y.

641. **Blocking and Thinning Sugar Beets.**

Maxson, Asa. C. *Louisiana Planter and Sugar Manufacturer*, Vol. LXXII, No. 21, p. 413. New Orleans, 1924.

Blocking consists in removing the greater part of the beets in a row and leaving small groups at regular intervals; in thinning, the beets left are reduced to one in each place. Each operation has an important bearing on the yield and quality. It is better not to thin the plants before they are two weeks old.

Spacing: The best results are obtained with a spacing distance of 12-14 inches, as the following data show:

Distance between Beets	Tons per Acre
8.5 inches	15.75
11.5 »	17.10
15.75 »	16.40
18.00 »	13.60
23.5 »	9.54

Wide spacing generally produces a beet low in sugar content. On soil of low fertility a slight widening is recommended. Too close spacing on rich ground crowds the leaves and sacrifices root development. Too wide spacing on rich ground produces a beet of low sugar content.

Experiments made in 1918, 1919 and 1920, show that large seedlings produce large beets, and although small beets may have a slightly higher sugar content, the total yield is less. W. S. G.

642. **Soil Temperature and Cane Germination.**

RAO, K. KRIOHNAMURTH, I. *Journal of Madras Agricultural Students Union*, Vol. XII, No. 1, p. 18. Coimbatore, 1924.

One of the chief factors in cane germination is the temperature of the soil at the planting season, at a depth of about 2 inches. The temperature varies, but is highest between midday and four in the afternoon.

The author subjected cane sets to various temperatures with the following results: — Cane sets kept for 4 hours at 55° and 50°C did not germinate; the buds were dead. Those kept at 48°C germinated but growth was unsatisfactory. Those at 42°C gave the best growth. Root development was best in the case of sets kept at 40°C and 42°C.

It may be stated in a general way that for cane planting, localities which have a soil temperature above 44°C (111°F) at the planting time are not the most favourable for germination.

W. S. G.

643. **The Devolopment of the Sugar Cane.**

TEMPANY, H. A. (Director of Agriculture, Mauritius), *Bulletin No. 9, Department of Agriculture, Mauritius*. pp. 16, Plates 4, figs. 15. Port Louis, 1924.

The author undertook these investigations in connection with an inquiry into the phenomenon of bud variation of the sugar cane.

Allusion is made to the work of the scientists and the subject is then treated under the following heads: — The underground system of the sugar cane, the development of a stool from a cane cutting; changes in the internal morphology of the stem during development; the function of stored sugar in the stem.

The Bulletin gives an account of the more salient morphological and physiological features attendant on the development of shoots from the eyebuds of the cane. The macroscopic changes are described and measurements given showing the rate at which the early stage of growth takes place. The internal morphology is indicated and the changes which take place when an eyebud germinates. An account is given of the manner in which the reserves in the parent stems are drawn upon, and it is shown that under the conditions at Réduit (Mauritius) the parent stem of a planted cutting contributes to the nutrition of the young shoot for at least 100 days after the cane is planted.

The composition of cane rhizomes is elucidated and the general resemblance shown to the composition of nodes on the aerial portion of the stem.

The view is put forward that the storage of sugar in the stem of the cane is a definite specialisation on the part of the plant, and is only in a minor degree, if at all, the result of human intervention.

Some tentative considerations are mentioned, respecting the probable connection between joint length of varieties and vegetative vigour.

W. S. G.

644. **Farm Practice on Hawaiian Sugar Plantations.**

C. A. B. *The International Sugar Journal*, Vol. XXVI, No. 304, pp. 186-191. London, 1924.

The article forms a review of the Report of the Committee on Cultivation and Weed Control, of the Association of Hawaiian Sugar Technologists.

Attention is drawn to the fundamental changes which are taking place in the sugar industry owing to the alteration in conditions, increased cost of labour, changes in methods of cultivation, etc.

The practices on unirrigated plantations in the islands are chiefly dealt with. Heavy applications of fertilisers are given to sugarcane and the question is asked as to the ultimate effect upon both the plant and the soil.

Current methods of cultivation are discussed. Plant canes, ratoons, liming and cultivation are considered, and finally, methods of weed control, such as mulching and spraying. W. S. G.

645. **Grafting in Coffee Culture.**

CRAMER, P. J. S. (*from Nederlanch-Indisch Rubber-en Theo Tijdschrift 1923*, Nos. 18, 19, 20) *Tropical Agriculturist*, Vol. LXII, No. 2, pp. 76-86. Peradinaya, 1924.

The author gives an account of coffee-grafting under the following heads: history; *Butin Schaap's* graft; the *Klein Getas* graft; the Kawisari graft; grafting of hybrids; graft hybrids compared with *robusta*; general approval of grafting; experiments at Bangelan Station; grafting on beds and field grafting. W. S. G.

646. **Coffee-Tree Cultivation on the Ivory Coast.**

ANTONETTI, R. (Lieutenant-Governor). La Culture du Caféier à la Côte d'Ivoire. *Les Cahiers coloniaux de l'Institut Colonial de Marseille*, No. 265, p. 70. Marseilles, 1924.

A circular on Extending the Cultivation of the Coffee-tree addressed by the Governor of the Ivory Coast to the "Commandants de Cercle".

The information obtained by the study of the collection of coffee-trees at the Bingerville Agricultural Station and the results given by the European and native plantations made in the Colony, and especially that at Elima, show that the coffee-tree can be successfully grown almost everywhere on the Ivory Coast, as with few exceptions, the soil and climate of the Colony are very suitable to this crop. The coffee-tree can be grown simultaneously with the cacao-tree on soil that is not suitable for the latter, and since the coffee crop is gathered later than the cacao, the profits of the planter might thus be increased without the expenditure of much additional labour.

Coffee-trees do exceedingly well in the districts of the Colony which lie north of the 7th parallel which is the limit of the cacao

As regards the best species to cultivate, *Coffea excelsa*, or "Gros Indénié", is very hardy and prolific and therefore well suited to the open ground to the north of the forest.

The best kinds to grow in the forest zone are *C. robusta* and "petit Idénie", especially the first, of which actual experience has proved the value, and the product is in great demand in France. These coffees have the merit that the they can be easily prepared with a native mortar and that their yields are high.

"Liberia" (*C. liberica*) on the other hand should be avoided, as it produces a crop of little commercial value.

Any native who has planted coffee or cacao-trees, and thus actually improved a portion of the property over which he only possesses the tenant right can obtain a definitive deed of concession on payment of a small nominal rent. F. D.

647. **Cost of Making a Coffee Plantation in the State of San Paolo, Brazil.**

Como se funda una fazenda de café. *Brasil Agricola*, Year X, No. III, pp. 68-73. Rio de Janeiro, 1924.

The author has himself furnished the data given in the following table for the year 1924 while those referring to the period 1890-1900 have been supplied by Dr. Guido MAISTRELLO. During the earlier period, the plantations were very little expense to the owner and showed their greatest development ; 400 *reis* being the cost per plant grown to the 4th year, during which time the coffee-planter was allowed to cultivate for his own benefit any other plants between the rows of coffee-bushes.

Cost of a Coffee Plantation in San Paolo.

	From 1890-1900	In 1924
	milreis (1)	milreis
Value of 200 alqueires (454 hectares) of land	40,000	100,000
Breaking up the land and cost of 200 000 young coffee plants.	130,000	200,000
Settlers' houses for 40 families	30,000	50,000
Threshing-floors	20,000	40,000
Machines for preparing the coffee-beans	20,000	35,000
Various improvements	20,000	30,000
Wages	10,000	15,000
Interest on capital invested	30,000	60,000

(2) One gold milreis = 2s.2 $^{62}/_{64}$ d. at par.

F. D.

648. **Tea in Japan.**

HARLER, C. R. (Chemist, Indian Tea Association). *Quarterly Journal of the Indian Tea Association*, Year 1924, Part I, pp. 3-46, plates 4. Calcutta, 1924.

The author gives an account of the tea industry of Japan. Descriptions are given of the tea districts, climate, soils, types of tea grown (green

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tea chiefly), methods of cultivation, manuring, planting, plucking, pruning, diseases and pests, methods of manufacture and costs, and interesting allusions are made to Japanese customs and ceremonies connected with tea. W. S. G.

649. **Cultivation and Distillation Tests of *Andropogon citratus* in the Royal Colonial Gardens at Palermo.**

BRENO, F. and SORGES, F. Ancora sulla utilizzazione industriale dell'*Andropogon citratus* D. C. *L'Agricoltura coloniale*, Year XVIII, No. 3, pp. 81-86. Florence, 1924.

Andropogon citratus has been grown experimentally in the Royal Colonial Garden of Palermo where it is found to yield an abundant supply of essential oil rich in citral.

From an unirrigated plot were obtained, in two cuts, in the second year, 365 quintals of leaves per hectare which gave 75.2 kg. of essential oil. From a similar plot that had been irrigated and cut once only the previous year, 821 quintals of leaves, containing 144.7 kg. of essential oil were obtained per hectare in three cuts, while another plot that had also been irrigated, yielded in 3 cuts, 854 quintals of leaves or 178.3 kg. of essential oil per hectare. Hence the amount of essential oil had been almost doubled by irrigation. If the leaves are left on the field for 24 hours only after cutting, the amount of essential oil is decreased and continues to fall in proportion to the time the leaves are left exposed to the sun's rays. It is, however, desirable to keep the leaves tied in bundles weighing about 3 kg., in a sheltered place, for the slight loss of essential oil is balanced by the evaporation of a large amount of water which reduces the cost of transport and distillation.

The percentage of citral oil in 1923 ranged from 68 to 74 and varies slightly from one year to another and in the different cuts (being highest in the first cut). It does not vary perceptibly if the essential oil is kept in dark-coloured bottles. F. D.

650. **The Utilization of Citronella Grass as a Preventive of Soil Wash.**

GEORGHI, C. D. V. *The Malayan Agricultural Journal*, Vol. XII, No. 1, pp. 7-11. Kuala Lumpur, 1924.

Several determinations of the oil content of Citronella grass (*Cymbopogon Nardus* and *C. Winterianus*) have been carried out in the Federated Malay States. The author described the cultural requirements of this plant and the process for extracting the oil. The yield of fresh grass per acre is estimated at about 5 tons and the oil production at about 60 lb. for each cutting. It is recommended, however, that although it is advantageous to plant citronella grass as a soil wash preventive on hilly land between rubber or other crops, which will eventually give shade, the yield of oil will begin to decrease after a few years, until a stage is reached when owing to increased shade it will no longer be profitable to distil the grass.

M. L. Y.

651. **The French Colonies and Tobacco Cultivation.**

CAPUS, G. Les Colonies françaises et la culture du tabac. *Bulletin de l'Agence Générale des Colonies*, Year 16, No. 191, pp. 1080-1092, Paris, 1923.

The author furnishes statistical data respecting the importation of tobacco into France and the amount supplied by the French Colonies. He calls attention to the possibilities of these Colonies and speaks of the work of the Permanent Interministerial Commission on Colonial tobacco. In conclusion, the author makes special mention of what has already been done in this connection both in Indo-China and the Kamerun.

R. D.

652. **The Effect of Injuries upon the Morphine Content of the Poppy.**

RAVENNA, C. Influenza delle lesioni sulla produzione della morfina nel papavero. *Le Stazioni sperimentali agrarie italiane*, Vol. LVII, Parts 1, 2, 3, pp. 5, 8. Modena, 1924.

In his previous experiments, the author found that crushing the sheath, cutting the leaves and removing some of the roots had the effect of greatly increasing the hydrocyanic acid content of *Sorghum vulgare*. He also noticed that any lesions of the tobacco stem increased the total amount of the alkaloids present in the plant, and has now proved by repeated experiment that, if the stalk of the poppy is injured by a cut 6 cm. long, 1 or 2 mm. broad and 2 mm. deep, the morphine content of the capsule is distinctly higher. In the five experiments made he obtained 0.40, 0.41, 1.22 and 1.10 and 1.82 parts per thousand as against 0.31 ; 0.39 ; 0.62, 0.57 and 0.85 respectively.

F. D.

653. **Plants Yielding Chenopodium Oil.**

PYNAERT, L. Les plantes produisant l'huile de chenopodium. *Bulletin des matières grasses de l'Institut Colonial de Marseille*, No. 3, pp. 74-77. Marseilles, 1924.

The one or possibly several species of *Chenopodium* in the Dutch Indies which yield chenopodium oil have not yet been exactly determined. Since 1917, the plant has been cultivated on the Balong plantation. M. P. L. BLAAUBOER described this experiment in the " Algemeen Landbouwwecklad " (Year 1919, p. 1645), and the author reproduces the information given in his article.

Propagation. — Chenopods can be propagated both by seed and by cuttings. The seeds are sown rather thickly in well-shaded boxes filled with sand and humus, care being taken to cover them only lightly with soil. After 6 or 7 days, when the seedlings are 2 cm. high, they are moved to beds where they are planted 10 cm. apart and carefully shaded. At the end of 15 days, the shade is gradually withdrawn, and later the seedlings are planted out, a ball of soil being left round the roots.

Subsequently, cuttings 8 to 10 cm. long can be taken and thus the production of new shoots is induced.

The beds for these cuttings are shaded and must be ploughed deeply and covered with 5 cm. of sand. The slips take root after 8 to 10 days ; the shade can then be removed and the slips are ready for transplanting.

Plantation. — At Balong, *Chenopodium* is grown as a cover-crop with Hevea in the second year. The *Chenopodium* seedlings are planted 30 by 30 cm. apart, in beds 1 metre in width which are ploughed to the depth of 30 cm.

Management. — All that this crop requires is strict cleanliness. At first, the seedlings must be kept fairly damp, but later, they are able to stand long periods of drought.

Although *Chenopodium* is an annual, the plants throw up new shoots and a second crop can be gathered if the weather is favourable.

Harvest. — Unripe seeds give only a very small amount of dark-coloured, turbid oil, while the peduncles and leaves contain no oil at all. Three or four months after the seedlings are planted, the first seed begins to ripen. Since the plants bear ripe seeds, unripe seeds and flowers all at the same time, the harvesting has to be done very carefully. The same plants are re-visited every 8 to 10 days.

Preparation of the oil. — The seeds need no treatmenet after gathering and may be distilled at once. As they are very dry they will keep for some time. Complete distillation takes 30 to 40 minutes. At Balong, a Derov (Paris) distilling apparatus is used. In order to lose as little as possible of the ascaridol (the active principle of the oil), the length of the distillation process should as far as possible be reduced and this is done by using apparatus of moderate dimensions. The separation of the oil is most satisfactory when the condenser is allowed to become extremely hot. The water obtained during the process must be evacuated, for if it finds its way into the boiler, loss of ascaridol ensues.

Yield. — The oil content of the fresh seed at Balong was about 0.8 %. In 1918 as much as 14 ½ kg. of oil were obtained per hectare of cover-crop. It may be calculated that a crop of *Chenopodium* grown alone would yield 25 to 30 kg. per hectare. Each plant supplies 10 gm. of seed at each picking and the seeds can be gathered every 5 days.

The author afterwards gives information derived from a lecture given by Dr. SULLIVAN on the subject of the cultivation of *Chenopodium* in Caroll country (Maryland, United States) and on the prices fetched by the crop.

R. D.

654. **The Cultivation of the "Chaulmoogra" (*Taraktogenos Kurzii*) in Brazil** (1).

I. PINTO, S. A. "Chaulmoogra" planta de resurreição. *Brazil Ferro Carril*, Year XV, Vol. XXVI, No. 345, p. 516, fig. 1. Rio de Janeiro, 1924.

II. Plantio de "Chaulmoogra" em Deodora. *Ibidem*, No. 341, p. 422.

I. On the occasion of the Centenary Exhibition (Rio de Janeiro 1922), a plant of « chaulmoogra » raised from seed by Prof. ROCK in Burma and afterwards taken to Washington was shown in the United States Section.

This specimen was subsequently entrusted to Prof. ROLFS Director of the "Escola superior de Agricultura e Medicina Veterinaria" at Viscosa in

(1) See *R.* 1923, No. 190. (*Ed.*)

the State of Minas Geraes. It was planted in the garden in January 1923, and has now made a fine growth, so that there is every hope that it will be possible to cultivate and acclimatise *Taraktogenos Kurzii* in Brazil.

II. The "Serviço de Fomento Agricola" has received from India a packet of Chaulmoogra seed which has been handed over to the Biological Institute for the Protection of Agriculture, in order that the seed may be sown at the Institute's farm at Deodora and the seedlings obtained compared with those derived from seed introduced from the United States.

F. D.

Aboriculture.

655. The Best Shape for Mulberry-Trees.

LAURENT, A. (Inspecteur général de l'Agriculture). Ministère de l'Agriculture, De la forme à donner aux mûriers. *Bulletin de l'Office de Renseignements Agricoles*, No. 15, pp. 278-279. Paris, 1924.

There is considerable difference of opinion as to the most satisfactory shape for mulberry-trees, because although many experiments extending over a long period and yielding decisive results have already been made, they do not appear to have convinced the advocates of the rival systems. It is also highly probable that experiments in this direction will give different results according to the district, the method of silkworm-rearing and the general end in view.

Hence the author has confined himself to quoting the opinions expressed by the Directors of the Sericultural Stations of Alais, Montpellier and Draguignan.

Alais Sericultural Station. — According to M. SECRÉTAN, the Director of this Station, dwarf mulberry trees possess the following advantages: *a*) rapid leaf production; *b*) intensive leaf production; *c*) better utilisation of the soil; *d*) the leaves are easily gathered and pruning is facilitated.

It is true that dwarf mulberry trees are more subject to injury from frost than taller trees, but any risk of damage from low temperatures may easily be avoided by choosing varieties that are late in coming into leaf.

The expenses of making and maintaining a mulberry plantation may be estimated as follows:

Cost of Making and Working different Kinds of Mulberry Plantations.

Type of plantation	Yield	Cost of making plantation	Cost of maintenance up to first year of production	Annual expenses of cultivation	Net cost per 100 kg. of leaves
	Leaves per hectare kg.	Fr. per hectare	Fr. per hectare	Fr. per hectare	Fr.
Tall trees in orchard . . .	17 000	3 865	10 500	2 615	15 to 17
Dwarf trees in orchard. . .	20 000	8 850	8 320	2 570	12 to 14
Dwarf trees on cordons . .	20 000 to 30 000	8 850	5 700	2 850	8 to 12
Dwarf trees in meadow . .	30 000	7 500	—	1 736	5

As regards the comparative food value of the leaves of tall and of dwarf mulberry-trees the analyses made show that: the leaves of the dwarf tree contain more water, nitrogen, ash, and phosphoric acid than those of the tall trees while their carbohydrate content is about equal and their crude cellulose and potash percentage is lower.

The specific gravity of the cocoons made by silkworms fed on the leaves of tall mulberry trees is less than that of cocoons spun by silkworms reared on the leaves of dwarf trees. The loss in degumming is greater in the case of cocoons made by silkworms fed on the leaves of the dwarf trees.

An ideal plantation should be composed of:

(1) hedges of wild mulberry trees sheltered by a wall, or sunny slope; (2) mulberry trees growing in meadows with fertile soil and good exposure; (3) a stand of dwarf mulberry-trees forming the basis of the plantation; (4) tall mulberry-trees planted in the low-lying ground, along the water-courses, and the roads of the estate with isolated individuals in the courtyard of the farm; (5) stands containing a few specimens of black mulberry in order to have food for the silkworms if the young foliage is cut off by spring frosts.

Montpellier Sericultural Station. — M. LAMBERT, the Director of this Station considers that the lower the mulberry tree is kept, the sooner it begins bearing, and the easier it is to pick off the leaves. On the other hand, low-growing shapes have the following disadvantages: 1) the leaves are more readily soiled with earth; 2) the trees are more exposed to frost; 3) the trees have to be protected from grazing stock; 4) they are only suitable for thick plantations or for hedges; 5) the leaves of dwarf trees or of those growing in meadows, are regarded as inferior to the leaves produced by tall mulberry trees, although this theory is not based on the **results of exact experiment.**

It is not advisable to rear the silk worms on the branches in all districts, or under every condition of cultivation and breeding. This practice requires a hot climate, allowing the mulberry-trees to be pruned annually, and is specially suited to silkworm-rearing on a large scale.

The Draguignan Sericultural Station. — M. BRANDI, the Director of this Station, is a warm advocate of tall mulberry trees. He has observed that annual summer pruning weakens the trees and prevents resistance to the attacks of their natural enemies. The yield of a dwarf mulberry-tree is at least two-thirds less than that of a grafted tree. F. D.

656. **The Negative Effect of "Pinching" on the Increase in Volume of Fruit.**

DUBT, E. De l'influence négative du pincement sur l'accroissement du volume des fruits. *Journal de la Société d'Horticulture de France*, Series 4, **Vol. XXV, pp. 48-49. Paris, 1924.**

The author has tried the effect of the repeated "pinching" from May onwards of the buds of pear-trees growing on Passe-Crassane espaliers. The pears were gathered on October 16, 1918, and the average weight of the fruit which had been pinched was only 280 gm. as against 338

gm. in the case of pears from untreated trees. These results confirm those of the author's experiment in the previous year and agree with the figures furnished by other horticulturists at Montreuil-sous-Bois (France).

The author further states that the 1924 fruit buds are more numerous and better shaped in the case of the trees of which the buds have not been pinched. R. D.

657. **Acclimatisation of the Pear-Tree in the State of São Paulo, Brazil.**

O Cultivo da pereira em São Paulo. *A Lavoura*, Year XXVII, No. 6, pp. 567-568. Rio de Janeiro, 1923.

All attempts at acclimatising European varieties of pear in the State of São Paulo have proved unsuccessful, for although the trees make growth they never bear any fruit ; Japanese varieties, however, do very well and have been widely cultivated in São Paulo of recent years, especially in the coolest part of the State between Mayrink and Taubaté. F. D.

658. **Artificial Pollination of Vines.**

Longo A. (Direttore della R. Cantina sperimentale e del Vivaio di viti americane di Velletri). Fecondazione artificiale dell'uva. *Nuovi Annali dell'Agricoltura*, Year IV, No. 1, pp. 61-78, figs. 10. Rome, 1924.

With a view to lessening the injury caused by the premature falling of the fruit and abortion which occurs in many varietis of vines, the author has for many years carried out a series of experiments in artificial fertilisation and the annular incision of the vine branches.

The results obtained showed that ringing the fruit-bearing shoots doubled and trebled the crop and was therefore an excellent method to adopt in the case of grapes for wine-making. It is however not advisable to ring vines bearing table-grapes, unless the object is merely to increase the size of the fruit in the normal clusters, as this treatment greatly weakens the vine.

The method of artificial fertilisation proposed by the author has already yielded surprising results. The cluster of flowers is laid in the palm of the hand and the half-closed hand is gently drawn upwards from near the peduncle to the top of the cluster, this operation being repeated two or three times. By this means the natural obstacles to autogamy, the enclosed condition of the anthers and the concealment of the stigmata, is removed.

The operation must be performed during the hottest hours of the day, since at this time, the dry corollas more easily become detached and fall, so that the pollen is more readily distributed. The vines must be treated two or three times at intervals of two or three days, especially when their flowering is irregular.

In order to obtain more certain results and also insure the advantages, accruing from cross-pollination, the operation can be completed as follows: Before touching the cluster to be fertilised, the operator lightly passes this hand over the flowers of any other variety of vine, and then dusts the adhering pollen over the flower-cluster he wishes to pollinate. F. D.

659. **Early Italian Table Grapes.**

SANNINO, F. A. Le uva da tavola precoci ed i diversi mercati di consumo. *Rivista di Ampelografia*, Year V, No. 5, pp. 05-67. Alba, 1924.

The "Lulienga", "Chasselas" and "Portoghese" varieties of grape grown in the plain of Milazzo on low horizontal, spurred cordons produce fruit that can be first on the market before the earliest Algerian and Tunisian grapes, provided the soil between the rows is moulded up in the neighbourhood of the cordons, that every fruit-bearing shoot is ringed, and the vines are well irrigated. From 1901 to July 1914, these Milazzo grapes were exported in large quantities from Sicily to Germany; later, an attempt was made to find a market for them in Switzerland and Italy, but the prices fetched did not pay the cultivation expenses. It is hoped that the ferry-boats recently started between France and England will make it possible to replace German grapes on the English market by Sicilian grapes. In Italy the fruit of the "Lulienga" "Chasselas" and "Portoghese" varieties, which has little flavour and is greenish in colour, is much less liked than the large, golden and sweeter Muscats. In order to render the grapes of the three varieties mentioned above more acceptable in Italy, it would be necessary, in the opinion of the author, to practise ringing which hastens ripening, increases the sugar content and causes the greenish colour to disappear.

Muscats can be made to ripen earlier by means of hybridisation. PIROVANO (1) has made many crossing experiments with this object in view.

F. D.

660. **Vine-Growing in the Island of Rhodes.**

CASELLI, A. La coltura della vite nell'isola di Rodi. *L'Agricoltura coloniale*, Year XVII, No. 12, pp. 401-413. Florence, 1923.

The conditions of soil and climate in Rhodes are very favourable for vines which, in fact, make wonderful growth and yield wines celebrated from the remotest times (HOMER). But from the time of the Turkish occupation, viticulture was continuously on the decrease and is now restricted to some tracts on the east and west coasts while there is none in the interior. These districts in 1923 produced respectively 230 000 and 630 000 okas (1 oka = 1.283 kg.) of wine grapes, or a total of 11 thousand quintals.

The principal varieties grown are: — "Diminiti," giving red grapes which ripen at the end of June — "Amorghiano" the commonest variety giving black wine grapes — "Athiri" the only white wine grape — Sultania — "Rosakie" giving table grapes.

Principal diseases: — Sunstroke and scorching of the grapes — dropping, probably caused also by the invasion of some insect which attacks the clusters when in flower; (efforts are made to limit the damage by smearing round the stalk a resinous substance known in the local trade under the name of "asparte"); vine mildew, to which all the vines are

(1) See *R.* 1924, No. 559 (*Ed.*)

equally liable. Injury by peronospora is rare. The island is still free from phylloxera, which has however invaded the neighbouring islands.

The vines are grown very low, wfth trailing shoots ; as it never rains before the grapes are gathered the bunches can rest on the ground without damage. Green pruning and manuring are unknown. The only tillage is a hoeing in March. The grapes are gathered from the end of August to the middle of October, according to locality. Production per hectare from 30 quintals of grapes (old vines) to a maximum of 150 quintals (young vines, in plains, of " Amorghiani " and " Athiri ").

On an average 7000 vines are planted per hectare at irregular intervals. According to the statement of the vintage account given by the author in the fourth year when production begins, there is an expenditure of 7600 lire per hectare and a yield of 50 q. of grapes ; from the sixth year onwards the net profit is 3000 lire per hectare.

The vine-stocks age rapidly, owing to the want of manuring.

F.D.

661. **Observations on the Forests and Woods of Madagascar.**

LOWOEL (Inspecteur des Eaux et Forêts). Notes sur les bois de Madagascar. *Madagascar et Dépendances, Bulletin Economique*, 3rd and 4th quarters 1923, pp. 183-204. Tananariva, 1923.

An account of the forests and woods of Madagascar. The author treats of the subject from the botanical, sylvicultural and commercial standpoints. The descriptions of the species and of the forests are supplemented by numerous illustrations.

R. D.

LIVE STOCK AND BREEDING.

General.

662. **Loss of Weight in Animals during Transport.**

DECHAMBRE, P. Pertes de poids des animaux pendant les transports. *Revue de Zootechnie, la Revue des éleveurs*, Year 3, No. 5, pp. 337-340. Paris, 1924.

Animals that travel, whether on foot or by rail, suffer loss of weight to a greater or less degree owing principally to the decrease in the content of the digestive tube which gradually becomes empty.

The live-weight is the first to be affected at any rate in ordinary journeys of average length or short duration, little difference being noticeable

in the net weight. If, however, the animals have to make a long or trying journey, the loss in net weight is very marked. The evacuation of the food and liquids which causes the fall in weight takes place chiefly on the first day, excretion being much diminished subsequently. An ox of 600 kg. will lose 30-40 kg. the first day and 5-7 kg. on subsequent days. This latter decrease is due to some extent to an interstitial reabsorption which takes place within the tissues, and it allows the fall in net weight to be estimated, for although at first this is little noticeable, it continues to increase with the length of the journey, especially if the animals are supplied with insufficient food and water.

In the course of the first 24 hours, the loss that occurs varies greatly according to the kind of animal, the breed to which it belongs, the distance travelled and the kind of transport. Cattle carried by rail lose on an average 25 to 50 kg. in weight according to their size, but this average may be greatly exceeded.

A lot of cattle weighed at a fair were found to have lost in the course of their transport to the abattoir 9.7 % of their weight, whereas another lot that had been driven in straight from the pasture showed a loss of 13.1 %. These losses affect the net meat yield the percentage of which is higher the greater the reduction of the animal.

A sheep weighing 40 to 50 kg. may lose 3 to 4 kg., and a calf of 150 kg. loses about 4 kg., the first day and 2 kg. the second. A pig of 100-110 kg. loses 5 to 6 kg. The loss of flesh is frequently *nil*, unless the distance is very long, the pigs extremely fat and the journey made in great heat, in which cases, an elastic litter that absorbs much moisture should be employed.

The question has arisen how far the fatigue, and even the suffering, endured by the animals in course of transport may alter the quality of their meat. It should be remarked in the first place, that there is a certain amount of mortality amongst all kinds of animals when travelling. This is especially the case with swine on account of their particular anatomical and physical characteristics such as skin that acts badly, layer of fat, small mouth opening, and narrow nostrils. The phenomenon known as fatigue-fever is caused by the accumulation within the organism of waste products such as creatin, creatinine, urea etc. that cannot be eliminated. After the animal is slaughtered, these substances come into contact with the air, putrefaction sets in and causes the rapid deterioration of the meat. It is most important on a journey of some length to see that the animals are provided with drinking-water at very short intervals.

A steer that travelled 5 km. on foot and weighed 782 kg. at starting, only weighed 740 kg. on arrival; it furnished 426 kg. of net meat, so that its dressing-yield which should have been 54.4 % was 57.4 %.

Many observations show that in the course of transport large losses in weight occur, the live-weight being first reduced through the evacuation of the contents of the digestive tube, and that these losses are able to affect the quantitative and qualitative yield of all butcher's animals.

P. D.

663. **Influence of Low Temperatures and of Disinfectants upon the Vitality of the Eggs of *Ascaris Lumbricoides*.**

CRAM, E. B. (Zoological Division, Bureau of Animal Industry, United States Department of Agriculture). *Journal of Agricultural Research*, Vol. XXVII, No. 3, pp. 167-175, tables 2, bibliography. Washington,. D. C., 1924.

The author has made many experiments in order to discover the effect of low temperatures upon the eggs of *Ascaris lumbricoides* at different stages of their development — recently laid — partially developed — completely developed, i. e., containing active embryos. After being exposed to the action of cold, the eggs were put back into a temperature of 24°C and their subsequent development, as well as their capacity for infecting guinea pigs, were studied. Recently-laid eggs and eggs that are partially developed have great powers of resisting low temperatures, the former continuing to develop after an exposure of 40 days to temperatures ranging from — 2°F to — 16°F., and the latter after having been exposed to the same temperatures for 20 days. The life of embryos that hatch out of eggs thus treated is however relatively short. Fully developed embryos are killed after being kept for 20 days at a temperature of — 2°F to — 16°F.; but 10 days of these temperatures and 30 days of temperatures of 12°F — 18° F. do not destroy them.

It may therefore be concluded that in practice the winter temperatures of pig-sties are not low enough to kill the eggs of *Ascaris*; the most the cold could do would be to impair their capacity of infection and reduce the danger of contagion by imprisoning the eggs in the frozen soil.

The author afterwards made experiments to determine the action of different disinfectants on the eggs of *Ascaris lumbricoides*. A 5 % solution of carbolic acid and a 3 % solution of cresol mixed with soap solution destroys the capacity of development of recently deposited and partially-developed eggs, and renders inactive any fully developed embryos. The effects of the first disinfectant manifest themselves after 10 hours, and those of the second disinfectant are apparent at the end of 5 hours, provided in both cases the eggs are completely immersed in the solutions. In practice, pig-sties can be satisfactorily disinfected by scraping off the mixture of eggs and saw-dust and thoroughly watering the mass with the disinfecting solution 4 times a-day for two consecutive days. The best means of destroying *Ascaris* eggs is by thoroughly cleaning the pig-sties; the mechanical action of scraping and rubbing and the temperature of the water used for scrubbing are of paramount importance. Disinfectants only supplement the cleansing operations and have little effect of their own unless thus assisted. P. D.

664. **Susceptibility of Weaned Calves to Cattle Plague.**

MOHAMMAD BEY ASKAR (Senior Livestock Officer). Experiments to determine the susceptibility of weaned calves to cattle plague. *Technical and Scientific Service, Ministry of Agriculture, Egypt, Bulletin* No. 2, 12 pp., graphic charts 3. Cairo ,1923.

In this Bulletin, the author gives a summary of the results he obtained from experiments conducted at the Higher School of Agriculture at Giza

from 1918-1920. He also refers to the researches carried out by P. CROVERI at the Serotherapic Institute of Italian Somaliland at Merca, in 1917, which had proved that calves born of cows actively immunised against cattle plague cannot react to double inoculation with cattle plague virulent blood and serum, on account of the accumulation in the organism of sufficient antibodies to render it passively immune. This passive immunity which disappears rapidly with the growth of the animal is maintained by the accumulation of new antibodies supplied by the mother's milk.

The author employed in his experiments 69 calves, varying in age from a few days to several months. The herd of cows kept at the Giza School is for milk and breeding purposes. The name of each animal together with date of serving, calving etc. is accurately registered in a herd-book. Every member of the herd was doubly inoculated with virulent cattle plague blood and serum in May or June 1917. In December 1917, a Cattle Plague Virulent Blood Institute was established in the School building and for fear of contagion all the calves were inoculated together as soon as a sufficient number were born. The calves at the School are left with their mothers and allowed the whole milk supply during the first fortnight. They are then separated and let loose in a special yard where green food is accessible and allowed only half the milk. They were weaned at four months.

When the calves were doubly inoculated, the virulent blood was taken from the Blood Institute, Giza, or from the Serum Institute, Abbâsîya, and tested for virulence on susceptible Cyprus cattle. Their temperatures were taken every morning and evening for 3 weeks. No symptoms of cattle plague ever showed themselves although in the more advanced calves a few cases of rise of temperature occurred. The author then decided to test some of these calves ; the result of the test revealed the susceptibility to cattle plague. Shortly afterwards, this result was confirmed by an outbreak of the disease among the immunised calves. It was then found necessary to re-immunise all the cattle. The author afterwards gives the results obtained from 12 first experiments of double inoculation and subsequent re-immunisation. The Table referring to the first experiment gives the name of the cows, dates of service, dates of double inoculation, time of pregnancy when the cows were doubly inoculated, dates of calving. The tables referring to all the 12 experiments give the names of the cows, dates of calving, results of first and of second double inoculation with virulent blood and serum.

The experiments may be divided into 2 categories : 1) Those on animals immunised when suckling and tested when almost full grown (11 experiments).

2) Experiments on animals immunised when suckling and tested 5 months later (12 experiments).

The author gives a detailed analysis of the results of the inoculations and of the tests in the case of both classes of experiments.

He confirms P. CROVERI'S view that suckling calves born of immune mothers are susceptible to cattle plague after they are weaned, but draws attention to the fact that temperature rises were observed in

Egypt during the double inoculation and testing of these calves both during suckling and after weaning. These rises are not likely to be accidental, since they occurred in a fair number of cases, and are probably due to cattle plague. The author remarks that the question necessarily arises whether the rapid growth of the young animals and the continual change of their cells may not have had such an effect upon active immunity to cattle plague that the cells which were stimulated to manufacture antibodies were continuously replaced by others that did not possess this property. In this connection, might not the periodicity of outbreaks of cattle plague have some relation to increasing susceptibility on the part of the calves born in a year of severe cattle-plague outbreak ?

Another point also arises viz the alleged fact that the suckling calves are passively immunised against cattle plague because the milk of their actively immunised mothers contains cattle plague antibodies. The rises in temperature which occur when suckling calves born of immunised mothers are doubly inoculated appear however to be mild conditions of indisposition. If such appearances indicate to any extent the presence of cattle plague, one would be more inclined to attribute such mild reactions to the antibodies in the mothers' milk. That the mildness of the attack is not simply due to the extreme youth of the animals is proved by the fact that on several occasions the author observed severe cases of cattle plague amongst suckling calves born of susceptible mothers. Whether such rises in temperature mean cattle plague or not, can only be proved by testing the blood (at the time of the rise) on susceptible animals. Again, the only means of ascertaining whether immunity in calves is permanent is by testing the animals at varying intervals after weaning until they are full-grown.

P. D.

665. **Treatment for Retention of the Placenta in Cows.**

POLI, A. Trattamento della ritenzione della placenta nei bovini. *La Nuova Veterinaria*, Year II, No. 5, p. 26. Bologna, 1924.

The author recommends on the strength of his own satisfactory experiments, a modification of the method adopted by WILLIAMS in America and OPPERMANN in Germany for the treatment of the retention of the afterbirth in cows. The chief advantages of the proposed system are its cheapness and simplicity which place it within the reach of all farmers. In case of simple retention of the placenta, all that is necessary is an antiseptic, aromatic douche, insufflation performed with ordinary bellows, and the application of 2-4-5 kg. or more of finely divided vegetable charcoal, the amount depending on the approximate capacity of the uterus.

If in addition to the placenta, other substance are also present, which indicate metritis and auto-intoxication, antiferments and febrifuges, such as quinine and salicylic acid, must be administered internally and the treatment described above carried out, ⅓ part by weight of finely powdered boracic acid being added to the vegetable charcoal.

P. D.

666. **Intra-Abdominal Laying in Hens**

HEIMAVI (Professor) and LEGROS (agrégé à l'École de Médecine vétérinaire) La ponte intra-abdominale chez la poule. *Annales de Médecine vétérinaire*, Year 69, No. 3, pp. 97-101 ; No. 4, pp. 157-162, Brussels, 1924.

Under the head of intra-abdominal laying, the authors include the passage into the abdominal cavity of the more or less formed egg through an accidental opening in the oviduct, as well as the direct fall of yolk from the ovary into this cavity. From various post-mortem examinations that have been made, it may be concluded that the passage of more or less completely formed eggs into the abdominal cavity is not likely to give rise to serious trouble so long as the yolk is surrounded by a layer of albumin.

On the other hand, the yolk frequently falls directly and unenclosed into the abdominal cavity ; this is a very serious accident which usually occurs when the reproductive apparatus is active, or even hyper-active, having been stimulated by special foods or drugs administered for the purpose of increasing egg production. Such treatment over-taxes the organism and weakens the oviduct. The authors quote the work of F. DEGROIS in collaboration with VOITELLIER, but mention certain points on which they are not in agreement.

The accident is always fatal and very sudden, although some birds show symptoms of indisposition for a few hours, and separate themselves from the others, remaining motionless with their heads buried in their feathers.

The dead fowls are always in good condition and often quite fat. The authors exclude all idea of ovaritis and reject any hypothesis of traumatism as an explanation of the fatal results. It should be noted that the deaths occur from January to October, being most frequent in April and May. The predisposition or resistance of the fowls does not appear clearly to depend on the breed, nor can the accident be due to microbic infection, since it occurs in birds that live in pens at far distances apart and have never come into contact with one another.

The mechanism of intra-abdominal laying especially as a cause of death is not yet well understood. It occurs invariably in good layers that have been fed intensively, and have a congested ovary and over-worked oviduct liable to become paralysed at certain times. The authors were much struck by the fact that the intra-abdominal deposit of yolk by itself was a very serious matter, whereas the intra-abdominal passage of yolk surrounded by albumen had no ill effects. They therefore made experiments in order to discover whether death in the first instance is not attributable to shock, that is to say, to an anaphylactic shock in the case of hens that have already laid, and a peptic shock without previous sensibilisation in the case of a pullet that has never laid before. This hypothesis was not confirmed by the results of the experiment. The authors then suggested another explanation. Having observed that lesions of the liver were always present in birds suffering from this affection of the reproductive system, they suggested that the absorption of part of the yolk by the peritoneal membrane

might be the cause of death. The constituents of the yolk may be toxic to the liver ; further since intra-abdominal laying is only found in fat hens with a liver overburdened with fat, it is probable that the already lessened proteopexic function of this organ may have undergone further change and end by being overwhelmed by a great reabsorption of protein substances. In short, death would seem to be due to a poisoning of the liver and the insufficiency of that organ. The treatment adopted may be preventive or curative. Prevention consists in risking a decreased egg production by reducing the hens rations, or in any case, giving no stimulating food or drugs. The curative treatment is the province of the veterinary.

The conclusions reached may be summarised as follows :

1) The direct fall of egg yolk into the peritoneal cavity of a hen is a very serious accident that often proves fatal.

2) The mortality due to the intra abdominal passage of the yolk is high, especially during the beginning of the laying period.

3) This accident may be attributed to the effects of very rich food containing meat or of drugs which produce permanent hypercongestion of the ovary and lead to the over-taxing of the oviduct.

4) The different breeds of good layers are all liable to this trouble.

5) The cause of death is not well understood, but at any rate, infection plays no part in the matter.

6) Death does not issue if the yolk is enclosed in albumen when it falls into the abdomen. P. D.

667. **Animal Nutrition.**

WOOD, T. B. University Tutorial Press, London, 1924 : in 16° pp. VIII + 226.

As stated by the author in the preface, this book (which deals with the use of products of the soil for animal nutrition) aims rather at a well coordinated and clear enunciation than at giving exhaustive information regarding every detail of animal nutrition. For those who desire fuller information a list of suitable works is given in the text.

In the chapters devoted to the calculation of rations the author has adopted a rather novel point of view, substituting for the system of model rations, maintained with very few changes since 1864 (the year of WOLLF's first publication), a much more elastic system of calculation according to the nature of the production desired from the animals. The book, which is completed by an analytical index, includes the following chapters : — Vegetable and animal metabolism — constituents of the plant — starch and sugar — cellulose and other less important carbohydrates — oils — proteins — other less abundant vegetable constituents — composition of milk — analyses of fodders — green forages — forage roots — cereal grains and their derivatives — pulse grains — analyses of linseed cake — various fodders — digestibility of fodders — model rations — comparison of the methods of slaughtering and metabolism for the determination of such rations — equivalents in starch (KELLNER's method and others) — calorimetry ; metabolisable energy — net energy — maintenance require-

ments ; pig nutrition — rations for winter production in cattle — fattening of cattle in pasture ; nutrition of lean cattle ; nutrition of sheep — rations for milch cows — nutrition of working horses — purchase of fodder.

F. D

668. **Effect Exercised on Fertility and Sex by a Diet Rich in Lecithin.**

MORANI M. Influenza di razioni ricche di lecitina sulla prolificità e sul sesso (Esperienze eseguite nell'Istituto zootecnico della R. Scuola sup. d'Agricoltura in Portici): *Rivista di Zootecnia*, Year 1, No. 4, pp. 110-120, tables 2. Portici, 1924.

The author first fed some rabbits for about 1 month on exactly the same diet and then divided them into two similar lots, the experiment lot (I) and the control lot (II).

Lot I received 26 gm. crushed vetches + 24 gm. hulled lupin seeds ; lot II was fed 25 gm. crushed maize + 25 wheat shorts. The evening ration of both lots was the same for both groups. With a view to eliminating any possible influence of the male upon fertility or sex, the author used the same buck-rabbit to serve both groups. This animal was fed the same ration as lot I so as to put him in good condition. The first litters were born in April.

Lot I. — *Ration rich in Lecithin.*

	Litter I	Litter II	Litter III	Litter IV
Number of births	10	21	30	35
Number of individuals surviving	2	16	30	26
Number of males	—	5	10	9
Number of females	—	11	20	17

Lot II. *Ration poor in lecithin.* 3 doe-rabbits proved infertile ; the other 2 produced a nearly constant number of young viz., 7 in the first litter, 8 in the second and 2 in the third, the number of males and females being about equal. These results would appear to show that a diet containing much lecithin effects the number of births and the sex of the offspring.

The author subsequently used the 3 doe-rabbits of lot II that had not produced any young in the first experiment. The same buck-rabbit was again employed.

Female No. 1 : 25 gm. crushed lupin + 25 gm. crushed vetches + 30 cc. 1 % physiological solution of glycerophosphoric acid. Produced 3 young.

Female No. 2 : 25 gm. crushed lupin + 25 gm. crushed vetches : Produced 1 rabbit.

Female No. 3 : 50 gm. shorts + 30 cc. 1 % physiological solution of glycerophosphoric acid. Proved infertile. It seems that the lecithin

in these cases stimulated reproduction in the animals that appeared at first to be sterile.

In order to judge of the influence of the lecithin upon the development of the progeny, the author weighed all the rabbits of the several litters on the 30th day after birth. The figures obtained clearly proved that the average weight of the young increased in the successive litters in direct proportion to the time during which the females had been given a diet containing much lecithin. At the same time, the dams of both lots were found to have increased in weight considerably more than those of the control group.

It may therefore be concluded that : (1) the lecithin present in vegetables has the same effect on fertility and sex as that exerted by pure lecithin ; (2) a diet rich in lecithin influences the development of the progeny ; (3) the use of foods naturally rich in lecithin (seeds or industrial residues) has a favourable effect on fertility and sex ; i. e., more young are born of which a larger number are females.

The author, however, is of opinion that before drawing any general conclusions, it would be well to repeat the experiments on a larger number of animals and also upon other animals of a different kind such as sheep and swine. P. D.

669. **Little-Known Stock Feeds : Maize Flakes ; Seaweed.**

GOUIN, R. Quelques aliments peu connus. *Revue de Zootechnie, la revue des éleveurs.* Year 3, No. 2, pp. 110-114. Paris, 1924.

Maize-flakes. — These are turned out in the form of dry, light scales of a fine lemon yellow colour and inodorous. They are poor in protein, but very rich in carbohydrates. Maize flakes are sold almost entirely oil-free ; as they contain little fibre, it is probable that their good elements are easy to assimilate and possess a higher digestibility coefficient than bran. Their starch value exceeds that of bran. It must, however, be remembered that the market value of maize-flakes is low, owing to their small nitrogen percentage. The following formula may be used in comparing commercial values.

(Nitrogenous substances + fat) × 2.3 + carbohydrates + digestible fibre = the market value of a food.

Maize-flakes suit all domestic animals, especially as a supplement to work, fattening or dairy rations. When fed to growing stock, care must be taken to add some substance rich in protein.

Seaweed is sold commercially under the name of " céréalgue ", and which is like a black, coarse tea with an unpleasant smell. The seaweed is treated in order to remove the excess of salts that would be injurious to animals. Its chemical composition is as follows : digestible nitrogenous substances 12.63 %, digestible fat 2.28, digestible carbohydrates 80.83, and digestible fibre 6.41. The starch value of this seaweed is 57.27, whereas the starch value of good red clover hay is only 35.6. Seaweed in the form of " céréalalgue " is suitable for working animals and butcher's beasts, especially when these animals are adult, for the treat-

[669]

ment to which the seaweed is subjected removes certain nutritive principles that are indispensable to young stock.

The author mentions a case of a horse being cured of lymphangitis by taking "Goémalgue", the therapeutic effect of the seaweed is probably due to the residual organic iodine.

The author emphasizes the fact that before using any new foods, it is necessary to obtain reliable guarantees of their origin and composition, in order to prevent fraud and also the possible poisoning of the live-stock.

P. D

670. **Food Value of Molasses.**

BRUNNICH, J. C. Molasses as Stock Feed. *Queensland Agricultural Journal*, Vol. XVI, Part. 2, p. 157. Brisbane, 1924.

The author draws attention to the fact that it is quite erroneous to suppose that maize and molasses have the same food value, weight for weight. Molasses is a carbohydrate food producing heat and energy, but is of no value in meat formation, as it contains no protein. Queensland molasses have the following percentage composition: Water 24-26; sugar 50-58; mineral substances 7-10; organic substances including amides 18-20. Its ash contains 38-40% potash, 8-24% lime; and 1-2% phosphoric acid. Stock-breeders value molasses as they whet the animals' appetites and make bulky dry food more savoury and more readily eaten. The large amount of amides, potassic salts and lime salts present in molasses is however sometimes inclined to interfere with the normal process of digestion and to induce diarrhoea unless this feed is given in due moderation. It is quite safe to give the following amounts daily as a supplement to the daily ration: per 1 000 kg. live-weight: horses 3-4 kg.; cows 2 1/2-3 kg.; steers 3-4 kg.; sheep 4 kg.: swine 5 kg. Molasses are often employed in combination with nitrogenous concentrated foods such as coconut cake, decorticated cottonseed cake, meat meal, etc. The food value of the product is high, but it is very important that it should to be as dry as possible in order to prevent fermentation and the development of mould. The best and most economical way of using molasses is to dilute them with 3 or 4 parts of hot water and add the concentrates just before feeding. In America, molasses are diluted and heated in special vats and then incorporated by means of mechanical mixers with hay, or chopped straw. Molasses do not suit young calves and should be fed with caution to cows that have just calved.

P. D

671. **The Artificial Fertilisation of Mammals and Birds.**

IWANOW E. De la fécondation artificielle des mammifères et des oiseaux. *Comptes rendus de l'Académie des Sciences*, Vol. 178, No. 12, pp. 1554-1555. Paris, 1924.

The author has made use of artificial fertilisation in the hybridisation of certain animals, e. g., in crossing the horse with the zebra and *Equus Przewalskyi* and in his experiment on the fertility of hybrids resulting from crosses between *Bison americanus* and *Bison bonasus* and horned cattle (*Bos taurus*). Artificial fertilisation has practical advantages as a re-

medy against sterility and of largely increasing the number of females that can be fertilised by a single male. It has been practised in service and stud stations in Russia since 1909 (1).

Since this date, no fewer than 8000 mares have been fertilised artificially, while artificial fertilisation has been adopted with conspicuous success in the case of cows, sheep and sows, as well as in breeding mules and large donkeys and on fur-farms where black and silver foxes are reared.

F. D.

672. **The Record Card of the Zoometric Service of France.**

RIGOTARDS L. Le concours général agricole de Paris. *Revue scientifique*, Year 62, No. 9, pp. 274-275, figs. 4. Paris, 1924.

The record card adopted by the "Service Zoométrique de France", which is similar to the figure (a schematic simplified form), bears two photographs, one in profile, and the other taken from above by means of an ap-

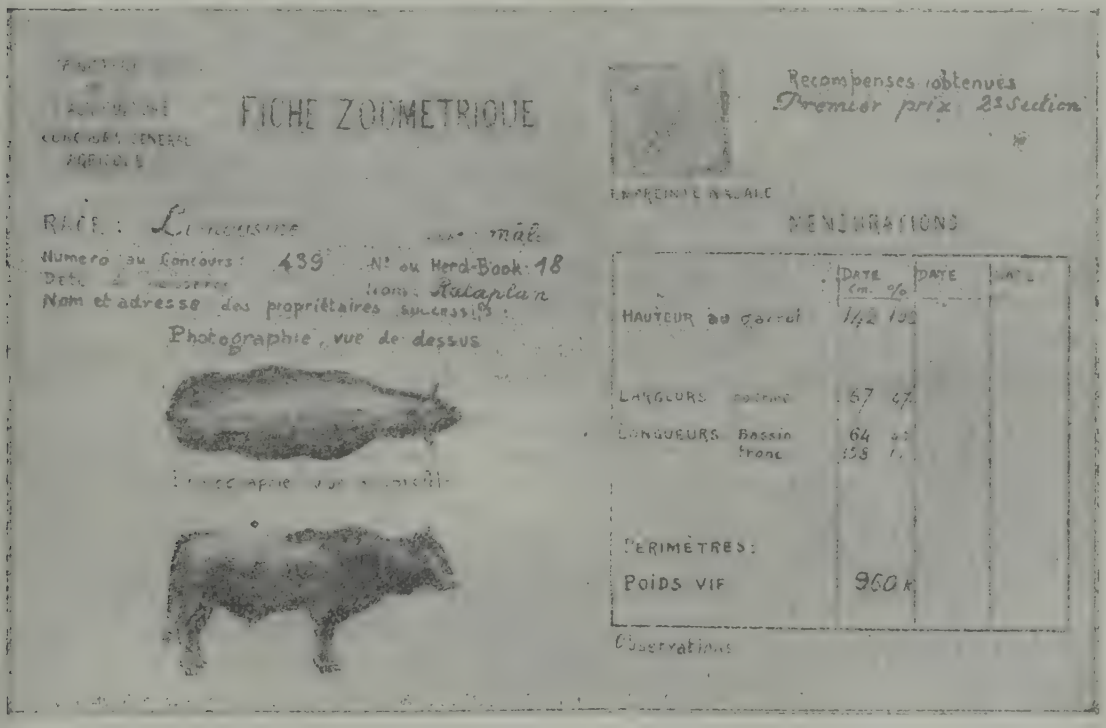

FIG. 96. — Simplified design for a zoometric record card.

paratus placed at a given height. These photographs are supplemented by a photo of the nose-print on plaster of Paris which is also attached to the record card. On the card are entered many measures not given on the appended form: height at withers, height of back, height at the sacrum, height of chest, height at trochanters and at hips; length of pelvis, and of body from nape of neck to tail; girth of chest, spiral measurement round chest; circumference of fore cannon-bone; live-weight in kilograms.

This record card is kept, and the measures subsequently taken are entered, together with the dates on each occasion. P. H.

(1) See *R.* 1923, No. 416. (*Ed.*)

673. **The Correlation between the Type of Horse and its Speed.**

PRAWOCHENSKI, B. (Chef de la division d'élevage à l'Institut National Scientifique d'Economie rurale à Pulawy (Poland). La corrélation entre le modèle des chevaux et leur vitesse. *Revue de zootechnie, la revue des éleveurs.* Year 3, No. 5, pp. 310-316, tables 2. Paris, 1924.

The effect produced upon the type of horse by racing is a much debated question among judges of horses in all countries. It has even been stated that the alterations produced in the English race-horses re-appear in their descendants with the result that the animals are deficient in flesh.

Dr. STRATIL after studying the measurements of fast and of slow thorough-breds and also of American trotters has come to the conclusion that very swift horses are more regular in conformation and have a larger circumference of chest than others. Some investigators on the other hand are inclined to regard the light, spare build to be more conducive to speed than a large heavy build.

The author who has had the opportunity of measuring many Russian trotters, approached the problem from the biometric standpoint and solved it by accurate and incontestable calculations. As the animals were registered officially, he was able to calculate the *coefficient of correlation* (PEARSON'S method applied by DAVENPORT) between the weight of the animals and their speed. In order that the height factor should not obscure the problem, he determined for each individual the *index of compactness* by dividing the weight in kg. by the height at the withers in cm. The various data are collected in table I and show that the positive correlation existing between the speed and the weight of trotters is too slight to allow that weight should be regarded as a factor favourable to speed, but at the same time, it proves clearly that no antagonism exists between weight and speed. The greater compactness of the swifter horses is probably explained by the necessity that they should possess more solid limbs, a broad chest and strong muscles.

In a second table, the author has tried to prove that the volume of horses is in correlation with their origin. He divides them into 4 classes according to their place of origin and states that the volume of the horses varies according to the region. The *mean index of compactness* for each region works out as follows: 2.82 for the first (black soils rich in lime); 2.77 for the second (Ukrainia, soil rich in humus but with lower lime content); 2.70 for the third (clay or sandy soil and marshes); and 2.58 for the fourth which has the same characters. It may therefore be concluded logically that the chief factor which determines variations in the compactness of the horse are to be found in the soil, and consequently in the grazing-ground. The author obtained the same results from an examination of the correlation between selection based on speed, the volume of the horses and the size of their limbs. Selection based on speed only gave secondary results as compared with the effect of the system of breeding and also the quality of the pastures and the food given to the foals. Selection for speed is not without its effect upon the type; it tends to remove superfluous weight in swift horses. It cannot, however, be said that the swiftest horses

have the longest legs. The elongated skeleton and relatively long legs found in many swift racers are due to their abnormal conditions of rearing, for they are kept in a stable, or a small field, and supplied with food, rich in albuminoids and poor in lime. P. D.

674. **A Zootechnical Research Expedition in East Congo.**

Marco F. (Professeur à l'Institut agronomique de l'État). Un voyage d'études zootechniques au Congo oriental. *Annales de Gembloux*, Year 30, No. 1, pp. 1-40, figs. 8. Brussels, 1924.

The author made an exhaustive study of the domestic animals in the region Ruanda-Urundi-Kivu. The cattle of this region are by no means homogeneous. From various measurements made of the cattle belonging to the laboratory herd at Kissegnies and representing the stock of different regions, it was found that in comparison with the animals of the Belgian Congo, the Ruanda-Urundi-Kivu type is higher on its legs, shorter in proportion to its height, of narrower build, and with a more tapering pelvis, The average weight of the animals is about 300 kg. The great mass of the cattle is apparently the product of the union of two basic types and they form a population which is in a condition of confused variation. The first of the types would appear to be the zebu, with much developed pendant hump, saddle back, short horns, highly developed muscles, good balance, croup nearly horizontal and well developed udder. The second type is shorter, has long horns, a more sloping and narrower pelvis, poor muscular development, a poorly developed udder and is less hardy. Between these two types are a large number of intermediate forms with characters resembling those of the short horned race. Red coats of all shades and pied-red coats predominate, but there are also dun, pied-dun, dappled black, pied-black, dirty-white, mouse coloured and pied-mouse coloured animals. The muzzle is black, bluish or light coloured with a few spots. The hair is smooth, fine and clings closely to the skin. The horns are smooth, slender and dark toward the points. Their direction and length vary considerably. The foreheads of the cattle may be deformed owing to the irregular direction of the horns resulting from the delayed ossification of the symphyses joining the cranial bones. On the whole, the outline of the head resembles that of rectilinear cattle. There are numerous cases of mutation : absence of horns, loose horns and horns that turn downwards. The author only found a complete absence of horns in cows.

The cattle reared according to the native methods develop late ; they weigh 20 kg. at birth and do not finish growing until nearly 6 years old in the short-horned type, and 7 years old in the long-horned. Earlier maturing animals can, however, be obtained by a more scientific method of breeding and by a better feeding of the calves when they are young. The cattle of Ruanda-Urundi-Kivu either have abundance of food, or suffer from scarcity alternately according to the season. The return of net meat reaches its maximum about January and falls to a minimum about June-July. From measurements made with th Crevat tape and from the information obtained the weight of the 4 quarters, may be said to be 45 to 50 % of the

live weight. Fat deposits only occur on the buttocks. Barotseland cattle slaughered at Elizabethville gave a return of 49 %, the weight of the fore-quarter being the same or higher than that of the hindquarter. The flavour of the meat varies according to the season. When a hump is present, its volume shows the degree of fattening.

Cattle are hardly ever used for traction, but should occasion arise, the yoke is attached to the horns, or in front of the withers. Young males are castrated when about 1 year old and broken in when about 3 years old. The bulls are kept until they reach 10-12 years of age, they are fairly docile, good at walking, but a little light. The cows are poor milkers, the udder being small and the mammary glands little developed. The average milk yield is 2-3 litres daily. The cows run dry early and only allow themselves to be milked in the presence of their calves. The milk is very rich in fat and 15 litres will make one kg. of butter if a separator is used, and 20-22 litres if the native method is adopted. The short horned type produces the best milkers.

When reared by the natives, the cattle lead an almost wild life. They are grouped into herds of about 50 head with one or more bulls and are driven out to the pastures in the morning where they remain until evening. In the dry season, they lie down in the brushwood without any litter. The only cleaning they receive consists in the removal of ticks. During the rainy season, the pasture grass is the sole food required by the cattle, but in the dry season, they have to be driven along the river-courses and into the valleys with fertile soil. Many of the animals are thus caused to perish from hunger and thirst and intestinal troubles, distomatosis and verminous enteritis are produced. The native tries to provide his cattle with salt by giving them salt plants from the marshes. The animals choose by preference clear running water to drink, but the zebu is known to bear thirst well.

The cattle breed in the open in the pastures and the sires are never selected. The characters valued by the natives are gentleness, fat and the capability of producing female progeny. Cows are esteemed according to their fertility, their milk yield and the number of female offspring. The cows calve for the first time at the age of 4 ½ to 5 years; the gestation period is longer than in the case of European cattle. The calves are insufficiently nourished which accounts for their late maturity and small size. A man does the milking; first he allows the calf to suck its dam and then he milks each quarter separately using only one hand; the calf is afterwards allowed to empty the udder. At first the calf is kept shut up, weaning takes place about the tenth month, and when the young animal is a year old, it is turned out to graze. The bulls are kept for a long time, but the cows are destroyed after their 8th to 10th calving. The milk is never consumed fresh, but is made into cheese by means of spontaneous coagulation or the addition of some native product. The dairy utensils are very primitive. Butter is used to some extent as a food, but chiefly as a liniment. The chief branch of trade is the sale of cattle hides. The substances used for preserving the hides vary in the different regions, but are generally unsatisfactory. Salt is used only

FIG. 97. — Short-horned type, true zebu.

FIG. 98. — Long-horned type.

FIG 99. — Intermediate type.

FIG. 100. — Distance between the tips of the horns : 2m.65

FIG. 101. — Dropping and swinging horns.

FIG. 102. — Ruanda goat.

Fig. 103. — Fat tailed sheep of Ruanda.

Fig. 104. — Dipping-tank

good results are obtained from brine ; drying however leaves much to be desired.

The sheep and goats of Ruanda-Urundi-Kivu. — The number of head amounts to 1 000 000. Goat and sheep breeding is not combined with cattle-rearing, sheep and goats being always the property of the small land-holder. In Ruanda, the sheep and goats are eaten, but in Urundi, the goat, and more especially the sheep, serves as a medium of exchange on the native markets. The sheep of Ruanda-Urundi-Kivu are descended from the Arkal sheep of the Asiatic steppes ; they are characterised by a deposit of body fat on the haunches only ; the tail is swollen like a roll from the base up to a third of its length and produces a mass of fat weighing 4 kg. or more. The wool is of inferior quality and often replaced by coarse hair. The sheep are 60-70 cm in height. The coat is white, but the head, neck and hind quarters usually are black, though occasionally the black is replaced by red. Some of the animals have uniform red, or pied-dun fleeces and black legs. The rams are horned, the ewes may be hornless. The general conformation needs to be improved for mutton production. The mountain sheep might be crossed with a wool-breed such as the Merino, or Romney Marsh, while in the plains, the native sheep ought to be crossed with a mutton breed, for instance, the Suffolk. The type of goat most widely kept is the Nubian which is remarkable for its height, its good conformation and high milk yield. The horns of the Nubian goat are inclined backwards. There is a short-haired variety and another with longer hair ; this type is more bony and gives less milk. It is dun coloured but its legs, the line along the back, the fore part of the head and often the lower part of the abdomen are all black, or else the coat is black and all the above-mentioned parts are dun-coloured. Individuals with pied-black, pied-dun, and tricoloured coats, black, white and dun, also occur. Most of the *swine* are of the Iberian type : with a longish body, sloping croup, long head, cylindro-conical, small ears, very low nasal angle, thin hair, and white, black or brown skin. The breed is very prolific, the animals fatten well, mature early and are hardy. Swine are only kept by the Europeans and a few chiefs. The pigs are turned out to graze and receive a supplementary maize ration. The animals are killed at the age of 9 months when they weigh about 100 kg. Measles is a common disease among pigs above the age of 5 months ; the only prophylactic measures taken consist in rearing the pigs in paddocks and in observing the rules of hygiene and cleanliness.

Farmyard poultry. — The natives rear fowls and Barbary ducks. The ordinary hen is small, its characters are variable, but it is a fairly good layer and an excellent sitter. The average weight of an egg is 40 gms. The flesh is of poor quality, unless the bird is fed a special diet. Europeans have successfully introduced foreign breeds such as Orpingtons and Faverolles.

No *horses* are kept ; although it would be possible to breed them. When proper roads have been made, mules could with advantage be bred for transport purposes.

The sanitary conditions of the cattle are quite different from those of

herds in European countries. Foot-and mouth disease only occurs, in a mild form, at all events among adult stock and tetanus is frequently curable. The effect of the environment upon parasites and the different resistance of the various breeds must be taken into account. The stock breeder must above all thoroughly know the various tropical diseases and make use of the help of the research laboratories which are investigating contagious maladies. The chief diseases are : piroplasmosis, East Coast fever, trypanosomiasis, cattle plague, scab, myosis, ringworm, foot-rot gangrenous coryza, anthrax, verminous diseases and coccidiosis. The symptomology of all these disease is invariable therefore the stock-breeder should keep himself *au courant* as regards laboratory methods, be able to handle a microscope and himself understand how to take samples of diseased matter for analysis. The chief prophylactic measures against contagious tropical diseases are :

1) The speedy detection of actual or suspected cases of transmissible diseases.

2) The destruction of the parasitic germs or agents, that have been disseminated in the infected regions.

3) Protection of herds and flocks against the intermediate hosts that transmit various maladies.

4) The vaccination, immunisation, or slaughter, of all animals, especially germ-carriers, as soon as they show signs of being sources of infection. The enforcement of the usual sanitary rules.

The author also makes observations on piroplasmosis and East Coast fever and shows the absolute necessity of exterminating ticks which act as disease carriers. The problem of colonial stock-breeding is mainly a question of the control of these parasites, for their presence renders it impossible to effect any improvements either within the breed itself, or by the use of stock belonging to improved breeds. Ticks are divided into three classes according to the number of hosts they require for the completion of their life-cycle. The first class consists of ticks passing all their life, from the larval stage to that of the adult female which gorges itself with blood, upon the same animal ; those of the second class live as larvae and nymphs on the same host, but migrate in the adult stage to the soil whence they infect a second host. The third class is composed of ticks that require three hosts. The larvae attack an animal, suck its blood and then fall to the ground and become transformed into nymphs which live at the expense of a second host, and again fall to the ground where they assume their adult form and then attack a third host. The most common tick in Russia is *Rhipicephalus appendiculatus*, a member of the third class. Ticks in sucking the blood of thir host, become infected with the parasites it contains and convey them to another animal. In addition to acting as disease carriers however ticks are also injurious in various ways :

1) They weaken their hosts which become anaemic and finally die. It may be noted that ticks can suck 48 litres of blood from one animal in the year.

2) The bites of the ticks cause wounds which allow parasites to enter and depreciate the value of the skins.

3) Tick attack decreases the milk yield, and frequently the lesions of the udder are such as to make the animal useless except to the butcher.

4) Tick-infested calves do not grow normally.

5) The fattening process is checked.

It is therefore indispensable that these parasites should be controlled. They can be destroyed by firing the brushwood, dipping, or immersion in arsenical baths, starving out by abandoning the pastures and dividing the cattle ranges into a certain number of enclosures.

The Ruanda-Urundi-Kivu region is of great promise for stock-rearing and has numerous markets at its disposal, for it could supply the Lower Congo and Stanleyville, as well as Albertville. It could also provide breeding-stock for the neighbouring stock-rearing regions. Efforts must however be made to improve the pastures and also the live-stock. It is necessary to practise systematic selection, to organise the control of external and internal parasites, to give instruction in the methods to be employed in scientific breeding and in the rules of hygiene etc. The author concludes by giving an account of the Katentania Breeding Station and suggests the best methods to be adopted for the improvement of the cattle.

P. D.

Special.

675. **Effect of Sub-Cutaneous Injections of Lactose upon Milk Production in Cows.**

CAMPUS, A. (Istituto di zootecnia ed ezoognosia della R. Scuola veterinaria di Bologna). Azione delle iniezioni sottocutanee di lattosio sulla produzione lattea delle vacche. *La Nuova Veterinaria*, Year II, No. 5, pp. 2-5; tables 8. Bologna, 1924.

The author studies the influence of sub-cutaneous lactose injections upon milk secretion using two Schwyz cows in his experiments. The animals were milked three times a day, always at the same hours and by the same person. The milk of each milking was very carefully weighed. The cows had a liberal supply of good quality hay always at their disposal.

Cow No. 1. — Had calved 3 months previously, was in excellent condition, weighed about 650 kg. Age 8 years. The experiment was divided into 3 periods. The first preliminary period lasted from February 9 to 28 and was divided into two periods of ten days. The milk yield showed a natural and progressive tendency to decrease. In the course of the first ten day period the average daily production was 11.823 kg., but fell to 11.353 kg. during the second period.

The second experimental period (March 1-30) was divided into three ten-day periods; 5 cc. of 5 % lactose were injected subcutaneously every day. A large increase in the milk yield was observed as compared with the milk produced during the last corresponding period in February. The daily increase was 595 gm. during the first period, 557 gm. during the second and 752 gm. during the third, *i. e.* an average daily increase of 645 gm. of milk for the whole month.

During the third period from March 30, the injections were suspended for 10 days and the milk yield was found to decrease greatly, during the third 10 days of March, the average daily milk production was 12.135 kg., and fell during the present period to 10.958 kg. *i. e.* the average daily decrease was 1177 gm.

From 10-19 April the injections were resumed with the result that the average daily milk yield rose 1175 gm,

From 20-29 April the injections were again suspended, the average daily milk production falling from 12.13 kg. (4th period) to 11.766 kg., thus showing an average daily decrease of 365 gm.

Cow No. 2. — Calved for first time 4 months previously. Age 3 years and average weight 390 kg. During the 20 days of the preliminary period, a slight fall in the milk secretion was noticed, viz., 17.593 litres for first period and 7.395 kg. for the second. The cow was given subcutaneous injections of 5 cc. 5 % lactose for 10 consecutive days which caused the average daily production to rise from 7.395 kg. to 7.555 kg. or an increase of 360 gm. per day. No injections were given for 3 periods and the fall in the average daily milk yield was 228 gm. in the first decade, 1.238 kg. in the second, and 1.028 kg. in the third. On resuming the injections for two periods, increase in the daily milk production was found to be 573 gm. during the first period and 675 gm. in the second as compared with the third period without injections.

The injection of 5 cc. of 5 % solution of lactose certainly causes an increase in lactic secretion. The favourable effect of the injection shows itself after the first day and is maintained throughout the time of the lactose injection however long it may last and ceases as soon as the injections are stopped, to manifest itself once more as soon as they are resumed.

From various estimations of the nitrogen and fat content of the milk it was found that there is no perceptible change in the amount either during the normal period, or when the cows are given subcutaneous injections of lactose. P. D.

676 The Relation between Age and Fat Production in Dairy Cows.

RAGSDALE, A. C., TURNER, C. W and BRODY, S. (Department of Dairy Husbandry, University of Missouri, Columbia, Missouri). *Journal of Dairy Science*, Vol. VII, No. 2, pp. 180-196, 1 table, figs 3. Baltimore, 1924

Milk secretion, like all other physiological processes undergoes certain changes as the animal grows older; it has been found that the average milk and butter-fat yield of a cow gradually increases until the age of maturity and then decreases progressively with the on-coming of old age even if the conditions of feeding and management remain unchanged. The determination of the age of maturity, as well as of the maximum milk yield and butter-fat production, and also the amount of increase in relation to age and successive lactations are all very uncertain questions and much debated by breeders.

At the time when the " advanced registry " (test) system was started, there were no certain data on these points, and hence the minimum requirements qualifying for registration were arbitrarily fixed. Now that this system has been in force for many years, thousands of annual or weekly records have been collected, which provide excellent material upon which to base an estimate of the relation between age and milk secretion throughout the life-time of the dairy-cow. PEARL and his fellow workers have already shown that the milk secretion curve has generally a logarithmic form. HOOPER, at the Kentucky Station, and CANDLISH at the Iowa Station, have also both proved that a relation exists between age and production. The authors give the results of a study based on more than 46 000 annual records and over 104 000 weekly records. The animals used in the experiment belonged to different breeds : Jersey, Guernsey, Holstein - Friesian, Ayrshire and Dairy Shorthorn, they are classified according to age with an interval of one year. It can be seen from this table that : 1) the age of maximum production varies little in the different breeds ; 2) the butter-fat production rises gradually until about the 7th or 8th year on an average, and then progressively declines as old age begins. The different inclination of the two curves shows that up to 8 or 9 years of age, the older the cow, the more easily does it fall below the required minimum, while after the animal has passed the age of 9 years, it has a constant handicap on account of the effect of age upon yield. In figure 106, the average production of all the tested animals of the different breeds is given in percentages of the maximum yield. With the help of this graph, it is easy to estimate what may be expected from a cow at

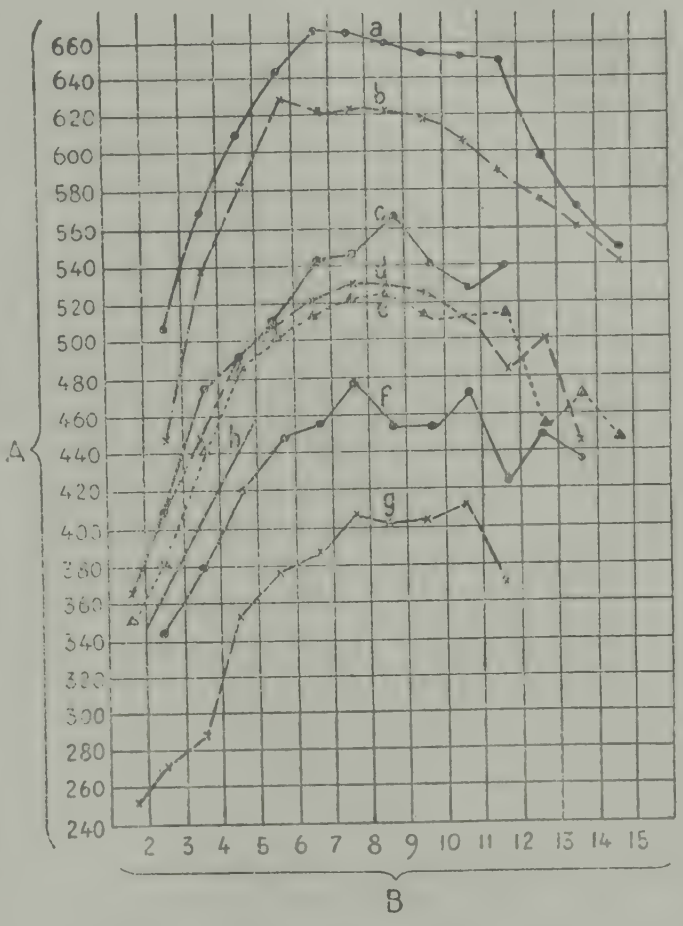

FIG. 105. — Correspondence between age and fat production in the milch-cow.

A = annual fat production ; B = age in years.

(*a*) Holstein; (*b*) Holstein (7 days. Records 36); (*c*) Holstein (305 days); (*d*) Guernsey; (*e*) Jersey) (*f*) Ayrshire; (*h*) Minimum requirements; (*g*) Shorthorn milker.

different ages in terms of its maximum production. Figure 107 shows that, in Jersey, growth (increased body-weight) and increased milk secretion follow the same course until the age of maturity. From this close relation it may be assumed that the ascending part of the curve representing milk-secretion is due to growth and its attendant physiological changes. After the cow is 9 years old, the milk secretion decreases and the descending portion of the curve is the measure of the degree of senescence. Milk secretion at different ages can indeed be regarded as the result of two physiological processes: growth and old age. This fact is of the highest importance from the standpoint of selection, for it makes it possible to compare the records of the yields at different ages. In order to study the power of breeding-bulls to transmit capacity for milk production to their progeny, it is necessary to convert the production records so as to obtain a comparable basis. By making use of table I, it is possible to calculate the equivalent record at the age of maturity for any given cow by means of the following formula :

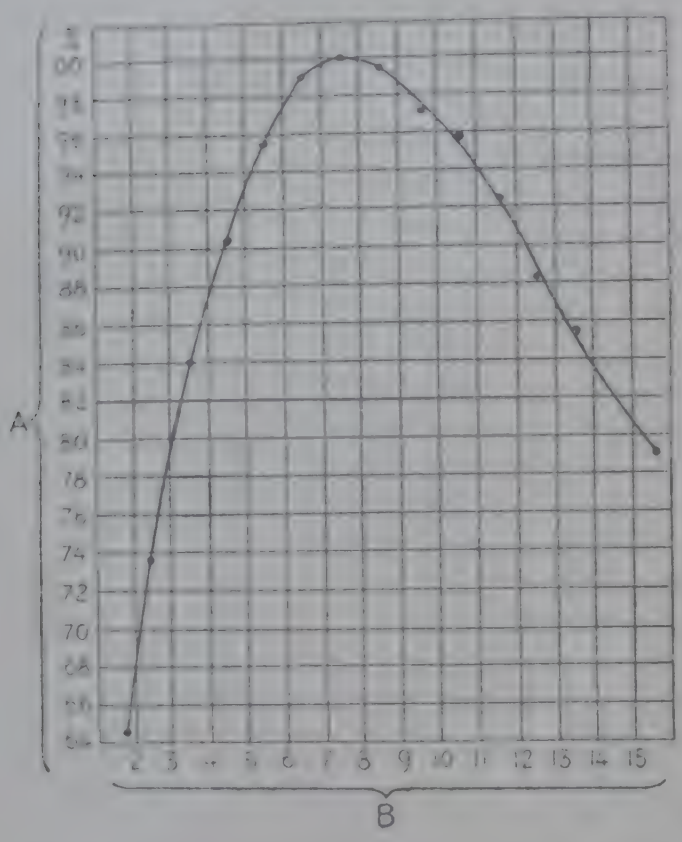

FIG. 106. — Relation between age and fat production expressed in percentage of maximum production.

A = Fat production in percentage of maximum production ; B = age in years.

$$\text{equivalent record at age of maturity} = \text{Total production at given age} \times \frac{\text{Average production of cows at age of maturity}}{\text{Average production of cows at the age for which the record has been calculated}}$$

In the case of a cow of given breed, the average figures for that breed given in the table will naturally be used.

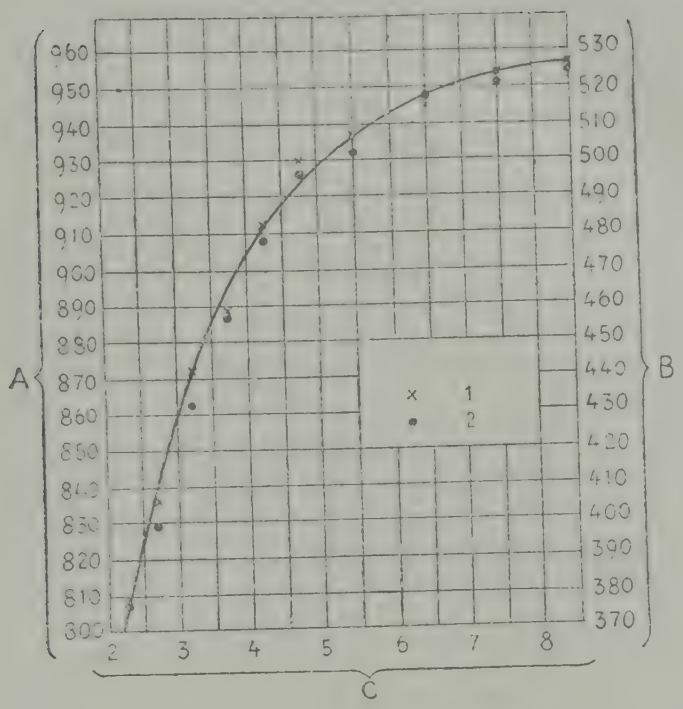

FIG. 107. — Relative increase in weight and fat production in the Jersey cow.

A = Live weight; B = annual fat production; C = age in years.

Relative rise in body weight and milk secretion in Jersey Cattle: × (1) Body weights; (2) Butter fat production per year.

P. D.

677. Variations in Milk Yield and Percentage of Fat according to the Different Quarters of the Cow's Udder.

FITCH, J. B. and COPELAND, L. (Department of Dairy Husbandry, Kansas State Agricultural College, Manhattan, Kansas). *Journal of Dairy Science*, Vol. VII, No. 2, pp. 169-173, Table 1. Baltimore, 1924.

The data relating to milk secretion, and especially to the variations in the butter-fat, are becoming of ever-increasing importance for cattle breeders. A first experiment on this subject showed that with a large number of cows, there is no appreciable difference in the fat percentage of milk drawn from the several quarters of the udder. An experiment was carried out by the authors at Kansas Agricultural College on 2 Holstein and 3 Jersey cows which lasted two days, or for 4 milkings. The milk from each quarter was drawn separately and the milk was also collected, weighed, sampled and analysed separately. A fortnight later, the same experiment was repeated with the object of verifying the results and to test the permanence of the variations recorded on the first occasion. The data collected show that the results obtained from the two experiments agree very closely. In the case of any given cow the milk from one quarter may always be more plentiful or contain more

butter fat than that of any of the others. Thus, for instance, the front right quarter of cow No. 5 yielded less milk than the other quarters. If, however, the average of all the cows is taken, it is found that no quarter is conspicuously superior to the others from the point of view of milk yield or butter fat percentage. The right hind quarter of cow No. 1 gave a richer milk than the other quarters in 6 out of 8 estimates, and at the same time yielded a larger quantity.

In conclusion, since more constant results are obtained from the estimation of the butter-fat in the milk from the different quarters than by determining the milk yield itself, it may be concluded that quarters with a low milk yield also produce little butter-fat.

P. D.

678. **Self-Rationing of Calves** (1).

CANDLISH, A. C. (Dairy Husbandry Section, Iowa State College of Agriculture and Mechanic Arts, Iowa. Studies in the Growth and Nutrition of Dairy Calves. Self-feeding a Grain Mixture to Young Calves. *Journal of Dairy Science*, Vol. VII, No. 2, pp. 160-162, tables 3. Baltimore, 1924.

The author, in continuing his experiments on the use of an automatic feeder in cattle-rearing, selected 2 Ayrshire calves 18 and 8 days old respectively, of which one weighed 18.5 kg. and the other 26.3 kg. at birth, and 2 Jersey calves, aged respectively 32 and 8 days, weighing at birth 23.1 kg. and 26.3 kg. respectively. At the beginning of the experiment, the calves were hand-fed with whole milk according to their requirements.

The experiment lasted for 6 periods each of 30 days. From the third period, the whole milk was progressively replaced by skim-milk. Good quality lucerne-hay was always supplied to the animals, which had also free access to salt and were watered twice daily. In addition, the calves had at their disposal a mixture of concentrated foods placed in a self-feeder. This mixture was composed of the following parts by weight : crushed grain 5, ground oats 2, wheat bran 2 and linseed-cake 1. From the examination of the table giving the total consumption, it is seen that the quantity of concentrates eaten was always larger than the quantity of hay. On an average, each calf consumed daily 1.54 kg. of concentrates and 0.54 kg. of lucerne hay. At the end of each experiment period, the live-weight of the animals was determined and various measurements were taken. By comparing the results of the present experiment with the earlier in which the calves were fed normally, it is found that the percentage increases in live-weight, height at withers, depth of chest and width of haunches were only 309 ; 34 : 57 and 67 respectively for the normally fed calves as against 491 37 : 50 and 77 for the calves using the automatic-feeder although they were the younger by 14 days.

From a comparison of the cost price of the food given to the calves up to the age of 6 months, the following figures are obtained.

Calves fed normally : 35.57 dollars ; calves fed by means of self-feeders but given a choice of concentrates, 35.81 dollars, present experiment

(1) See *R.* 1924, Part. I. p. 188. (*Ed.*)

29.96 dollars. The cost per lb. of live-weight increase was respectively 14.4, 14.1 and 10.4 cents.

Hence the present experiment shows that calves can be fed economically up to the age of 6 months on a mixture of concentrates as given above, if this food is placed at their disposal in an automatic feeder. F.

679. **Influence of Feeding and Care upon the Production of Dairy Cows.**

ECKLES, C. H. (Minnesota College of Agriculture). Influence of Feed and Care. Comparison of Records made under Official Testing and Cow Testing Association Conditions. *Hoard's Dairyman*, Vol. LXVII, No. 10, p. 302, tables 2, graph 1. Fort Atkinson, Wisconsin, 1924.

In the course of the last few years, the application of official testing for the advanced registration of dairy cows belonging to pure breeds has considerably increased the milk and butter production records. The question, however, arises how far the increase thus observed should be attributed on the one hand to the use of better methods of breeding and selection, and on the other to a more scientific knowledge of the rules of feeding and management. The Cow Testing Associations have also been an important factor of making for progress in the improvement of the dairy cow. The records obtained by these Associations have, however, been always considerably below those made under official testing for advanced registration. Whether the great discrepancy between these two records is due to the hereditary qualities of the animals, or is not rather caused by differences in feeding and care is the question that the author has set himself to solve. In the first place, it is necessary to observe the different conditions under which the animals live during these tests. A cow being tested for advanced registration is specially prepared by liberal feeding during the period preceding calving ; during the test, the animal is milked 3 or 4 times daily, suckling and reproduction are temporarily suspended and every care is given. In the case of control by the Cow Testing Association, milking is only done twice daily, the cow is again served so as to obtain a calf within the 12 months, while the food and care given cannot be of the same character as in the first case.

The author has collected, on the various farms belonging to the Agricultural Colleges, records referring to herds that have been subjected successively to these 2 methods of testing. The cows furnishing the data were 41 in number and belonged to 4 different breeds, Jersey, Guernsey, Holstein and Ayrshire. The results obtained by official testing and by the Testing Associations, respectively are compared in a table and the data show that cows subjected to official testing for advanced registration yield 70.7 % more milk and 64.9 % more butter-fat than those tested in the ordinary way. Hence under normal conditions, a cow can produce on an average 55-60 % of its official record. The figures given in the table show that the differences between the records made by official testing and ordinary testing are greatest in the case of animals with the highest official records. On dividing the 41 animals into 2 groups : *a*) those with an official record of over 271.8 kg. of fat and *b*) those with an official record of less

than 271.9 kg. of fat, it is found that the increase of butter fat is 52.6 % and that of milk is 90.5 % in the first group, whereas in the second group it is respectively 48.4 % and 52.9 %.

It may therefore be concluded that the high figures recorded during the official testing for advanced registration are due to the high productive capacity of the cow combined with the most favourable conditions of feeding and management which give full play to the manifestation of this productive capacity. P. D.

650. **The Value of the Results Obtained from Milk Testing.**

BERGE, R. La valeur des résultats fournis par le contrôle laitier. *Comptes rendus de l'Académie d'Agriculture de France*, Vol. I, No. 16, pp. 496-499. Paris, 1924.

Owing to the influence brought to bear by the "Offices agricoles", many Milk Testing Associations have recently been formed in France. It is therefore a matter of considerable interest to ascertain the degree of accuracy obtained according as the tests are carried out at longer or shorter intervals. This study was made by MM. LAPLAUD, DE LA FRÉGONNIÈRE and DUFFAU at the National Centre of Stock-Breeding Experiments at Vaulx-de-Cernay.

If each cow is considered separately, the errors in testing the amount of the milk yield do not increase in proportion to the length of time elapsing between the tests, but if the average results obtained from a group of 10 cows are taken, it is seen that the errors in the case of tests carried out weekly — fortnightly — every three weeks — every month, are respecvely 1.04 — 1.48 — 2.08 — 2.68 as compared with the errors made in daily testing.

The same is true of the testing of the butter-fat.

Two sources of error that are as important as periodicity are incomplete milking and weighing. The amount of error due to the first is unknown; the error in weighing with the instruments usually employed is from 1 to 2 %. A third source of error may also be mentioned viz., the possible incorrect reading of the graduated tube by the tester.

These observations show that daily tests of milk and of butter-fat yield may not prove more accurate than periodic tests. F. D.

651. **The Selection of Cattle and the Proportion of the Three Categories in Net Meat.**

BERGE R. Sur la sélection des bovins et la proportion des trois catégories dans la viande nette. *Comptes rendus de l'Académie d'Agriculture de France*, Vol. X, No. 11, pp. 375-378. Paris, 1924.

The following statement are taken from a work by MM. LAPLAUD and DEGOIS.

Hitherto, the principles by which the breeder has been guided in meat production may be summarized as follows. It is necessary not only to seek to obtain the largest amount of net meat, but also the fat-

gest possible development of those parts where the meat is of best quality, moreover the more these parts are developed, the smaller will be the meat of the third class. The authors, on the other hand, concluded from the results of experiments that the proportion of meat of first quality is nearly constant in net meat and that the question of race is of little importance in this connection.

" The improvement of beef breeds does not consist in the improbable increase of the prime cuts, but selection should aim at obtaining earlier maturity, better assimilation, aptitude for fattening and good conformation which help to improve the appearance, grain, tenderness and flavour of the meat, as well as the meat yield ". F. D.

682. **Annual Milk Production in Italy.**

PIROCCHI, A. Sul bestiame lattifero in Italia. *Annali dell'Istituto sperimentale di Caseificio in Lodi*, Vol. I, Nos. 5-6, pp. 158-166, Lodi, 1924.

In this statistical paper, the annual milk production in Italy is given at about 40 million hectolitres. The milk comes chiefly from cows, though a certain amount is furnished by ewes, goats and buffaloes in the order given. F. D.

683. **Management of Cattle in Denmark.**

CARRÉ, G. (Professor of Agriculture). L'exploitation des bovins au Danemark. *Journal d'Agriculture pratique*, Year 88, Vol. 2, No. 13, pp. 256-259, figs. 2, Paris, 1924.

There are in Denmark about 2 500 000 head of cattle which are almost exclusively dairy cows kept to provide butter for export. The milk is forwarded to the co-operative dairies which are widely diffused throughout the country and have done signal service for the improvement of breeding by instituting milk and butter testing, practising strict selection and popularising methods of scientific feeding. Two distinct races of cattle are to be found in Denmark: (1) the pied-black Jutland of average size and probably belonging to the Breton and Dutch breeds ; this race is suited to the less fertile districts. The cows weigh from 400 to 500 kg. and give an average annual yield of 3000 litres of milk with 3.5 % of butter-fat ; (2) ;the " Red Island " Breed which is more widely kept and has long been selected. The coat colour of this race is a dark, uniform brown, the mucous membrane is pigmented. The cows much resemble those of the Flemish breed, they weigh 450 to 500 kg. and yield annually 4000 litres of milk producing 117 kg. of butter. There are a few herds of Jersey, also a certain number of large short-horned cattle of the Shorthorn type that grow quickly, but are poor milkers.

The chief anxiety of the farmer is the production of sufficient food for his herd, a fact which explains the predominance of forage crops and of hoed crops in rotation. During the summer, the cows graze on the artificial pastures that are composed of a mixture of gramineae and leguminosae and thus provide a complete forage for the animals which never suffer from flatulence. The cows are fastened to a stake, the rope being placed

round their neck or horns ; they are moved several times daily as required. In the peat-moor districts, natural meadows are to be found where the cattle graze freely, often in company with horses. The winter lasts 7 months, so that food, including dry forage, roots and concentrated foods, has to be stored in considerable quantities. The cakes most used are those made of linseed, sunflower-seeds from Russia, or cotton seed from America. As much as 4 kg. of cake are given in the daily ration. Beets and swedes are kept in silos covered with soil. The troughs are supplied with water from a tank filled by a pump, worked by a windmill. The sheds have a double row of stalls with a passage down the middle ; they are ceiled and very well lighted. The animals heads' come above the trough, their necks being allowed free movement while their hind legs stand on the edge of a deep channel into which the excreta fall and are carried away by a stream of water into a large covered drain outside the cow shed. The Danes use no litter, and as the cows have to lie on the floor of the shed, they frequently suffer from chills.

The cows calve late in the spring, the young animals are suckled for 3 weeks, and are then fed a mixture of whole and skimmed milk supplemented with meal. Milking is very carefully performed ; the milk is put into cans containing 20 to 40 litres and fetched by the carts belonging to the co-operative, the cans being returned filled with whey. P. D.

684. Cattle-Rearing and the Dairy Products Industry in Brazil.

I. — De Abreu, L. M. Selecção de gado Caracú. *Revista agricola industrial e commercial Mineira*, Year II, Part 2, pp. 96-98. Bello Horizonte, 1924.

II. — Da Mensagem do Sr. Dr. Washington Luis Pereira De Sousa, Presidente do Estado de Sao Paulo. *O Criador Paulista*, Year XVIII, No. 7, pp. 84-86, Sao Paulo, 1923.

III. — Emrich, O. T. (Escola agricola de Lavras. A producção leiteira do Oeste de Minas. *Revista agricola industrial e commercial Mineira*, Vol. I, Part 5, pp. 408-409. Bello Horizonte, 1923.

IV. — Os lacticinios en Minas, *Ibidem*, Vol. II, Part 117, 1924.

V. — Vaccas de Leite no Rio. Sua producção annual. *Ibidem*, Vol. II, Part 2, p. 87, 1924.

I-II. *Selection of Caracu cattle* — Señor De Abreu calls attention to the good points of this fine breed of native cattle. The animals are large and well-shaped, gentle, hardy and produce both meat and milk. In the State of São Paolo the breed has been much improved by selection, the same steps should also be taken in the State of Minas Geraes, cross-breeding being carefully avoided.

At the " Posto de Selecção of Nova Odessa (São Paolo) Caracú cattle have been selected ever since 1909, the year in which the Station was founded. The maximum weight then attained was 781 kg. for bulls 8 years of age and 541 kg. for cows of the same age. In 1922, the weight of bulls 5 years of age had risen to 968 kg. and that of cows of the same age to 661 kg. and these wonderful results had been obtained in 12 years.

III and IV. *Milk Production and the Dairy Products Industry in the State of Minas Geraes.* — The cattle at present reared in this State are multiple purpose animals with no special points. The cows often give less than 2 litres of milk daily. But at the large dairy-farms with pure-bred cows the daily milk yield may reach 10 litres, while as much as 5 litres aday is obtained from cows belonging to well-fed, carefully tended herds from which the unproductive animals have been weeded out for some years (1).

The natural conditions of the country are eminently suited for the establishment of a large industry of dairy products. There are various factories for cheeses etc. and their success speaks well for the future prospects of this industry. In the factory of the " Companhia Industrial de Lacticinios " at Barbacena, cheeses of the Prata, Gruyère, Port Salut and Cabocò type are made. The Noguira Red and Co. firm has started a cheese-factory where 5000 litres of milk are handled daily at S. Gonzalo de Sapuh. The type of Prata cheese manufactured finds a ready market. The " Leiteria Leopoldiense " has several factories. In 1923 over 2 million litres of milk were sent to the Santa Isabel dairy ; about half a million litres were consigned to the Leopoldina factory which turned out 119 quintals of butter, while the Juiz de Fora factory took 1.4 million litres. The firm has bought other establishments at Cataguazes and Recreio and has entered into contracts with the " Companhia Mineira de Lacticinios ".

V. *Dairy Cows in the Federal District of Rio.* — In 1920, there were in the " Districto Federal de Rio " 23 367 head of cattle of which 5259 were cows kept on dairy-farms approved by the Prefect and yielded a total of 27 420 litres of milk daily *i. e.* 5.2 litres per head and per day.

The annual milk production is about 10 million litres, while 33 million litres are consumed of which 48.4 % come from the State of Minas Geraes 30.3 % from the Federal District and 21.3 % from the State of Rio de Janeiro.

The present milk consumption could easily be increased ten-fold which means that there is a great future before the breeders of pure-blood dairy cows in the Federal District. F. D.

685. Connection between the Amount of Fat in Ewe's Milk, the Yolk Content and Fineness of the Wool and the Animal's Quality as a Milk-yielder.

MACALIK. B. (Ing. agronome, former Director of the Institut Supérieur d'Agriculture at Prerov, Czecho-Slovakia). Rapports entre la quantité de la matière grasse du lait des brebis, la teneur en graisse et la finesse de leur laine et les facultés laitières. *Le Lait*, Year 4, Vol. IV, No. 33, pp. 193-200. Lyons, 1924.

The glossy character of the wool of a ewe is often regarded as a secondary index of the milk-yielding qualities of the animal. This idea is based

(1) See *R.* 1917, No. 1044. (*Ed.*)

on the supposed embryological relation existing between the sebaceous glands and the udder; it is said, the more marked the sebaceous glands, the more glossy is the fleece and the more developed the udder. The author after exposing the fallacy of the belief in a connection between the development of the sebaceous glands and the glossiness of the wool by drawing attention to the fact that a glossy wool is not necessarily full of fat, but sometimes quite the contrary, attempts to show the real relation between the development of these glands and of the udder. The author employed ewes in the experiment as they react better than cows to the various conditions that are necessary to the careful estimation of the connection and more readily allow comparable results to be obtained. The fat produced by the sebaceous glands is entirely retained by the wool, and ewes graze on the pastures throughout the season and thus produce milk under the same conditions, variations in quantity or quality, due to the nutrient character of the ration, being thus avoided.

The author, however, mentions certain conditions that may cause a variation in the results. (1) The difference of breed: merinoes for instance give little milk but have wool that is very rich in yolk, whereas Friesian sheep are excellent milkers and their wool contains little fat; (2) the age of the animals; although the fat content of the wool is nearly constant throughout life, the amount of milk obtained in different years is very variable and after the third or fourth lambing, the ewe gives more milk than after the first or second. Only animals in the same lactation period are therefore comparable; (3) the health of the animals during the lactation period; (4) the richness of the pastures which varies considerably from year to year. Thus, in order to obtain results that can be compared, it is necessary to collect the data of a single year, ascertain the total amount of milk produced by the ewes and the total fat content of this milk during each control period.

The author analysed a series of 75 wool samples taken from different selected flocks and from the fleeces of good, fair and bad milkers respectively, and in this way he was able to solve this problem, which is of great theoretical and practical importance, especially in the choice of breeding-rams.

He noted at once that the wool from the various parts of the body varies in composition.

Fat Percentage of Wool.

Withers	Back	Rump	Shoulder	Hip	Average
11.15	11.25	10.41	9.23	9.28	10.26

This observation led him to the conclusion that when the sheep belong to the same breed, there exists, in the case of any given animal, a relation between the yolk content and the fineness of the wool.

The following results have been obtained in a milk control that has been in progress since 1921, in Slovakia.

School of Zaturcie : Valaque or Racka Breed of Sheep.

No. of Sheep	Milk production 1921 litres	Milk production 1922 litres	Fat content of milk %	Amount of fat produced gm.	Yolk content of wool
1	53.6	86.1	8.0	6 888	9.11
11	57.9	135.6	7.9	10 713	10.89
12	45.0	107.7	7.3	7 862	11.15
13	55.7	56.6	7.0	3 962	10.48
20	40.9	39.3	7.9	3 104	10.25
28	44.3	37.6	7.1	2 669	7.48
29	33.0	37.2	8.9	3 160	10.19
113	46.2	55.0	8.6	4 958	10.41

By taking a milk yield of 50 litres as a minimum, 51-100 litres as fair, and above 100 litres as a maximum, the following averages were obtained.

Lactation	Amonnt of milk litres	Amount of fat gms:	Percentage of fat in wool
Minima of groups	38	2 977	9.3
Mean » »	66.6	5 279	10.0
Maxima » »	121.6	9 287	11.0
Average minimum	37.6	2 669	7.48
Average maximum.	135.6	10 713	10.89

These data, which have been confirmed by others obtained with pure-bred Friesian and Cigaïa sheep, and cross-bred Friesians × Cigaïa, Racka × Friesian and Cigaïa × Racka, show that there is actually a relation between the fat content of the wool and the amount of milk and fat produced.

Subsequently, the author made a study of the wool in order to ascertain whether there was any difference in the fineness of the wool of good and of bad milkers. The " Valaque " breed has 3 classes of wool in its fleece, " jarre ", " duvet " and " brin de chien ". The fleece of good milkers contains the minimum of " jarre ", the maximum of " duvet " and an average amount of " brin de chien " ; the fleece of fair milkers contains an average quantity of " jarre " and " duvet " and the maximum of " brin de chien ", whereas the fleece of bad milkers is characterised by the maximum of " jarre ", nearly the maximum of duvet and the minimum of " brin de chien ".

On comparing the weight of 1000 fibres of all the classes of wool, the author found the wool of good milkers to be the heaviest and that of poor milkers the lightest. Microscopic analysis has shown the " jarre " and " duvet " of good milkers to be thicker than those of bad milkers. A study of the total diameter of the fibres and of the medullary substance explains the coarseness of the " jarre " in the fleece of ewes with large milk-yield. The cuticle of the fibre of " jarre " is the same in both good and bad milkers.

The author obtained the following results from a study of the wool of milch ewes of the Friesian breed. The average weight of 1000 fibres is the same for good and for bad milkers, but the weight of 1000 fibres of the same length (10 cm.) is 0.164 gm. for good milkers and 0.150 gm. for bad milkers. The wool of good milkers is therefore in this case also heavier than that of bad milkers. The microscopic analysis of the wool shows that in good milkers it is made up of 78 % of heavy fibres, whereas the proportion of such fibres in bad milkers is only 68 %. In short, the results of the study of Friesian sheep coincide with the facts revealed by the investigation of the Valaque breed.

Hence the author concludes that a correlation exists between the quality of wool and the milk-producing capacity. The greater the amount of yolk to be found on an average in the wool, the higher the fat content of the milk, provided that all other conditions are equal. P. D.

686. **Sex in Sheep.**

LAPLAUD, M. and GARNIER, A. La masculinité et la femininité dans l'espèce ovine. *Revue de Zootechnie, la revue des éleveurs*, Year 3, No. 3, pp. 164-168; No. 4, pp. 256-265. Graphic Charts 3, tables 4. Paris, 1924.

The authors have obtained the necessary data for their study of sex in sheep from a Flock-book with carefully registered daily entries dating from 1904. For the breeder the question is a simple one, for he reckons a *posteriori* on the number of male and female births being equal, since he assumes (without any grounds for his belief), that it is a case of drawing lots from an urn containing a constant number of males and females. The frequency of male births varies, for instance, from year to year, but it takes several years to verify the famous law of chance, which seems to be an experienced fact, that if a large number of series is taken, the differences diminish. When continually longer series of matings and lambings are taken to determine the number of male and female births, the deviations decrease and the frequencies vary closely around ½. The proportion $\frac{M}{F}$ of the number of males to females denotes masculinity. The theoretical frequency, the theoretical distribution of the deviations, and the comparison of the known with the theoretical distribution of deviations will be of great importance for the detection of fraudulent entries in pedigree-books.

The authors give a table showing the lambing results from 1904 to 1921 inclusive; (M + F) denotes twins composed of a male and a female; (2 M) twin males and (2 F) twin ewes. There were on an average 90 sheep that dropped 47.7 M and 48.3 F, 31 lambs were born dead; 16.15 of the ewes proved barren, and 16 twin births were recorded, 8.1 being (M + F), 3.6 (2 M) and 4.2 (2 F). Hence it may be concluded that 100 sheep produce 100 lambs of which 50.3 are females and 40.7 males; to these must be added the lambs that are born dead. Out of 100 ewes, 16.8 prove infertile, and the loss is made up by the twin births; 33 % of the lambs are twins, which means that the twin births are 16.5 % of the whole

number of births. Here again, the sexes are clearly almost equal, there being 48 % males as against 52 % females. Triplets (which occurred twice in 18 years) may be regarded as anomalies.

As regards the division of the sexes at birth, there were during the whole period studied, 850 males and 870 females, or 101 females to 100 males. This proportion is however by no means absolute, for it can be altered in either direction by making the computation after a " male year ", or a " female year ", respectively.

The authors' table shows the irregularity of the sex distribution. During the period under discussion, there were 9 " male years and 9 " female years ". On studying the chronological order, there seems to be no periodicity in the succession of the " male years " and the " female years ". Yet any decided variation in one direction is followed by a variation in the opposite direction and the same fact is noticed in the case of many slight variations in the same direction, which would appear to prove the existence of two limits to the variations in the proportion $\frac{males}{females}$.

For the period studied, the maximum was 62 % males and the minimum 37 %. These two figures are equidistant from the equilibrium of 50 % males and 50 % females. Further, during the 9 male years, 827 lambs (459 males and 368 females), were born, whereas in the 9 female years, there were 401 males and 502 females, or 903 lambs in all. Taking the number as 100, we have : in the male years, 55.3 males and 44.5 females ; in the female years 44.4 males and 55.6 females. The proportions are thus inverse which would seem to confirm the hypothesis of a limit. The average difference of 11 % is probably an indication of the average variation of the proportion.

The authors next consider the sum of the production of the successive years. Taking the number of lambs as 100, they separated the totals for 1904-1912 from those for 1913-1921, and plotted the graph which shows : (1) that the same degree of variation occurred in two successive years ; (2) that the actual degree of variation is greater in " female years " than in " male years " ; (3) that the fall in the curve becomes very regular before the change of sign.

The twin lambs represented 1/3 of the lambs born, and it seemed desirable to examine the possible relation between twin births and the " male " and the " female years " respectively. Only the (2 M) or (2 F), births are to be considered, for when one of the twins is male and the other female there is no difference in the division of the sexes. In the 9 " male years ", 2 M occurred 44 times, i. e., 67.6 % and 2 F 26 times i. e., 34.3 % ; while in the 9 " female years " 2 M occurred 2 times or 32.4 %, and 2 F 51 times or 65.7 %. The proportions are not so strictly inverse as before, but they show the existence of the two limits and the equidistance of both these limits from the average. Further, twin births of one sex are usually distributed according to the lambing sign. In considering the effect of twin births upon the division of the sexes, they must be considered as single births and the number of births is divided by 2.

On arranging the results in the form of a table it is seen that twin

births seem to obey the above mentioned law of equilibrium and only affect the ratio M when their number exceeding the average 16.5 % rises to 20 % at least, that is to say, that the twins born do not affect the sign of the year unless their number is far above the average. In the course of their experiments, the authors adopted the plan of dividing lambing into 4 periods dating from the birth of the first lamb to that of the last. They tried to discover whether the division of the sexes at the beginning of lambing gave any clue to the sign of the year. From the results thus obtained, they conclude that the first quarter of the lambing season is generally marked by the " sign " that will characterise the entire season.

On the other hand, the ratio of $\frac{M}{F}$ during the first quarter is no criterion of the value of $\frac{M}{F}$ in the whole lambing season; similarly, the proportion of twin births during this first quarter gives no information as to the proportion of twin births that will occur in the entire lambing season.

The above-mentioned law of equilibrium appears also to apply to this fraction of the total number of lambs born. P. D.

687. Experiments in Improving the Native Sheep of the State of Minas Geraes, Brazil.

EMRICH, D. T. (Escola agricola, Lavras), Melhoramento dos carneiros nacionaes. *Revista agricola industrial e commercial Mineira*, Vol. II, Part I, pp. 9-11, Bello Horizonte, 1924.

The agricultural School of Lavras (Minas Geraes), imported some Hampshire sheep from the United States for the purpose of testing their capacity of acclimatisation and their suitability for crossing with the native sheep in order to improved the Brazilian breed. The Hampshire sheep were found to do very well in their new surroundings, provided they received sufficient care and were kept in the shade during the hot hours, provided with shelter at night, shorn before the summer began and supplied with supplementary rations in addition to the pasture grass. Under such conditions, the sheep kept at the School produced lambs which retained unaltered all the breed-characters.

The hybrids of the first generation were much superior in type to the native sheep and had larger fleeces. When in yolk, the fleece of the acclimatised Hampshires weighed about 3 kg., while those of the hybrids and of the native sheep weighed respectively 1.5-2 kg. and 1-2 kg. The loss in washing varied around 80 %. The fineness of the wool of the hybrid and of native sheep descended from the merino breed is about the same. F. D.

688. Natural or Artificial Rearing of Sucking-Pigs.

LAPLAUD, M. and DEGROIS, E. Nombre de porcelets à laisser aux truies et allaitement artificiel des porcelets. *Revue de zootechnie, la revue des éleveurs*, Year 3, No. 5, pp. 317-323. Paris, 1924.

In order to insure that the sow rears her young satisfactorily, it is necessary, as soon as she begins suckling, to determine her nursing capacity

and decide how many piglings shall be left to her to bring up. The nursing quality of a sow is frequently estimated from the number of her teats; an animal with 14 teats being considered a better nurse than one possessing only 10 or 12. This is, however, a mistake for there is no proof that the total quantity of milk obtained from 14 teats is greater than that drawn from 10. Thus it seems reasonable to suppose that the number of teats is not the chief element upon which to reckon the nursing capacity of a sow. The best criterion is afforded by an examination of the teats themselves. A firm udder with turgescent teats is a good index of milk production. If the brood-sow retains its general good health after farrowing and does not lose flesh or suffer in any way during the nursing period, it is a good indication that the animal has a plentiful milk supply.

The number of piglings to be left with the sow depends upon the number of teats, the animals' nursing capacity, and especially upon the economic object in view, whether the rearing of a number of animals of average quality, or the selection of breeding-stock. Many breeders leave selection to take place naturally, reckoning that the inferior products will succumb. This is not, however, a satisfactory solution of the problem, because the best animals are thereby deprived of the food that would contribute to their full development and render them resistant to disease. It is evident that the best plan is to weed out the most puny piglings. The authors classified the piglings of sows according to their weight at birth and at the end of each month. With few exceptions, all the piglings remained in the class to which they had been assigned at birth. It is thus certain that as a rule the young pigs with the best future before them are those that weigh most when they are born, and this fact can be taken as a sure basis for selection.

Artificial rearing. A sucking-pig taken from the mother can be easily reared on cow's milk, although the milk of the cow contains less fat and albuminoid substances than sow's milk. The pigling soon becomes used to the new food and grows well. Artificial rearing is often necessary in the case of pigs, either because there are not enough teats for all the farrow, or because the sow is a bad nurse, or suffers from mammitis. If the piglings are too many, some of them must be entirely bottle-fed; if the sow is a bad nurse, either all the smallest piglings can be left with her, a bottle being used to supply any deficiencies, or else a half the litter can be left with the dam while the other half can be reared artificially. It must be borne in mind that colostrum has special physiological properties, so that it prepares the digestive tube for the reception of solid food; for this reason, it is well to leave the piglings with their mother for 2 or 3 days. For the first fortnight, young pigs can only suck, so a feeding-bottle is indispensable for artificial rearing. The best food for the young animal is unboiled, tepid milk at the temperature it leaves the teat. Boiled milk should only be used if the presence of any pathogenetic micro-organism is suspected. Ordinary milk gives good results and therefore it need not be enriched by the addition of albuminoids, or lactose. The piglings should be given a bottle at least 4 or 5 times daily. After the second week, the milk can be put into a dish, for the

piglets soon learn to drink. At the end of the first month, some easily digested foods may be added to the ration; barley meal or manioc flour, and mashed potatoes, the amount fed is gradually increased until at last the stage of concentrates (cake) is reached. Then the whole milk can be replaced by skim milk, and later, the piglings are weaned. The essential thing is to proceed slowly and regularly, always keeping in mind the fact that cow's milk has a lower digestibility coefficient than sow's milk and that this difference has an effect upon the assimilation of the foods consumed at the same time. The authors give various instances of artificial rearing and a comparison between the piglings of the same farrow, some of which were suckled by their mother, while the others were bottle fed. The conclusion reached by the authors was that artificial rearing is often necessary, but can only be regarded at best as a make-shift. Certainly, piglings thrive best on their mothers' milk, though if necessity arises, recourse can be had without fear to artificial rearing which, if carried out properly, will insure normal growth. P. D.

689. **Observations on the Prolificness and Fertility of the Large Black Sow in Italy.**

VOLPINI, A. Della prolificità e fecondità delle scrofe. *L'avvenire zootecnico umbro*, Year IV, No. 5, p. 6. Spoleto, May 1924.

As a result of observations made on over a hundred sows of the Large Black breed, the author in 1922 obtained the following data respecting their prolificnes 4 % of the sows farrowed 14-18 piglings per litter; 52 % 10 to 12; 28 % 7-9; 10 % 5-6; 5 % 3 to 4; 1 % 1 to 2.

The total average number of piglings farrowed per sow was 9.24 and of these 8.20 were reared; 95 % of the deaths of the piglings were due to accident.

During several years of observation the author has never met with a barren animal and cases of temporary infertility were due either to errors of management, or to faulty service on the part of the boar.

F. D.

690. **The Bacon Pig.**

Agricultural Markets Report, Ministry of Agriculture and Fisheries, Vol. XXI, No. 2, pp. 2-3. London, 1924.

The Ministry of Agriculture of Great Britain has recently issued a leaflet on the subject of "The Bacon Pig" and single copies may be obtained on application to the Ministry, 10, Whitehall Place, London, S. W. I. This leaflet follows the suggestion of the Linlithgow Committee in their report on Meat, Poultry and Eggs, which states that "There is a serious disagreement between breeders as to the best type of pig for bacon purposes. The competition between the numerous British breeds results in nothing being done to provide the curer with a standard and uniform article. The Danish conquest of the British market is largely attributable to the way the farmers' associations in that country have induced their members to

abandon their personal preposesssions and agree on a type of pig suited to the bacon market", and proposed that the Ministry af agriculture should collaborate with the bacon curers with a view to a definite and authoritative prenouncement as to the best type of bacon pig.

Dealing generally with this subject, the Ministry states that there can be no question that the large home demand for bacon of the best quality is inadequately met by the British producer. The rearing of pigs at the present time would be very remunerative.

It is generally agreed that the best type of bacon pig is that obtained as a first cross of the better breeds, one of them being one of the large breeds to obtain length of side. It is rarely wise to go beyond the first cross, as, if this be done, the progeny often fails in uniformity of type. An example of a suitable cross is that of Large White boars for their length of side and Middle White sows to secure more rapid growth and a better ham and streak. The reciprocal cross also makes a very good bacon pig.

The leaflet also refers to the question of feeding, and the undesirability of using an excess of certain foods such as swill, maize, linseed or fishmeal, is pointed out. F. D.

691. **Maize and Hog Ratios in the United States, 1910-1924.**

Crops and Markets, Vol. I, Supplement No. 4, p. 117. Washington, D. C. 1924.

Number of Bushels of Maize Required to Buy 100 *Pounds of Live Hogs, Based on Averages of Farm Prices of Maize and of Hogs for the Month.*

Year	January	February	March	April	May	June	July	August	September	October	November	December	Average
Average 1910–1922	11.59	11.60	11.78	11.50	10.81	10.35	10.39	10.48	10.80	11.55	11.92	11.63	11.21
1910	12.2	12.0	13.6	14.4	13.3	12.9	12.2	11.7	13.0	14.2	15.1	14.9	13.3
1911	15.3	14.4	13.7	12.1	10.7	9.8	9.4	9.9	9.9	9.3	9.3	9.2	11.1
1912	9.1	8.8	8.6	9.0	8.4	8.1	8.3	9.1	10.1	12.0	13.2	14.1	9.9
1913	13.6	13.9	14.4	14.4	12.7	12.3	12.1	11.1	10.2	10.4	10.5	10.3	12.2
1914	10.8	11.3	11.2	10.9	10.3	9.9	10.1	10.3	10.3	10.0	10.4	10.2	10.5
1915	9.5	8.6	8.4	8.5	8.7	8.7	8.7	8.5	9.2	10.8	10.6	10.1	9.2
1916	9.8	10.5	11.4	11.5	11.4	11.0	10.9	10.6	11.0	10.4	10.1	9.8	10.7
1917	9.9	10.5	11.5	10.3	8.8	8.3	7.4	7.7	9.0	10.1	11.2	12.0	9.7
1918	11.2	10.3	10.1	10.2	10.3	10.0	9.9	10.1	10.8	11.0	11.5	11.3	10.6
1919	11.1	11.3	11.2	11.1	10.8	10.2	10.5	10.2	9.3	9.7	9.2	9.2	10.3
1920	9.3	9.2	8.9	8.4	7.6	7.1	7.8	8.5	10.1	13.0	15.0	13.2	9.8
1921	13.5	13.5	14.3	13.0	12.5	11.0	13.1	14.8	14.0	15.9	16.0	15.2	14.0
1922	15.4	16.5	15.8	15.7	15.0	14.7	14.7	13.7	13.4	13.4	12.8	11.7	14.4
1923	11.1	10.9	10.2	9.8	8.8	7.9	7.5	7.7	8.5	8.8	8.2	9.0	9.0
1924	9.0	8.5	8.6	—	—	—	—	—	—	—	—	—	—

P. D.

Poultry.

692. **The Function of Grit in the Gizzard of the Fowl.**

KAUPP, B. F. (Poultry Investigator and Pathologist North Carolina Agricultural Experiment Station). *Journal of Agricultural Research*, Vol. XXVII, No. 6, pp. 413-415, fig. 1, tables. Washington, D. C., 1924.

The first first points to be considered in the study of nutrition in poultry are the part played by grit in the gizzards of the birds and the length of time it is kept in the gizzard, as by this means it can be determined: how often the fowl should renew its supply of grit, whether it habitually uses an amount in excess of its requirements and whether, in this event, the surplus is retained in the gizzard. The author's experiments were conducted on Barred Plymouth Rocks, 2 or 3 years of age; the birds were kept in pens provided with a false bottom of wire-netting which allowed of the excrement being at once removed, so that the fowls could not take up any of the gravel that had been evacuated. The fowls were killed at different intervals and the grit-content of the gizzard was determined each time. The experiment lasted 365 days; the food was analysed daily, and the birds were weighed every day in order to find out whether the supply of grit they had taken up was enough to allow it to insure normal physiological functioning of the gizzard. The author gives a table showing the results of his experiment. From these data it can be seen that a bird can be given no grit for 365 days and yet have sufficient left in the gizzard to crush its food. At the end of this period, one fowl had still 5.89 gm. grit in its gizzard, viz. as much as was present in a bird killed on the 30th day of the experiment. Further, the grit is as angular at the end of the time as at the beginning. According to the author, the digestive process seems to be as follows:— The foods ingested are absorbed by the crop more or less thoroughly according to the time they remain in this organ and then pass into the proventriculus where they are subjected to the action of the secreted acid juices and finally enter the gizzard. The walls of the gizzard contract and by means of a rotary movement crush up the food with the action of a mill. The particles of grit swallowed with the food aid in the process. It has been found that the health of the birds is not affected whether the grit is angular or rounded.

Fowls have a tendency to take up more grit than they require; the excess is evacuated with the excrements. The amount retained in the gizzard varies according to the individual. One fowl that died on the 156th day had 14.03 gm. in its gizzard which is far more than was found in the gizzards of birds killed on the 14th and 21th day respectively.

P. D

693. **Effect of Inbreeding on the Winter Egg Production of Rhode Island Red Fowls.**

HAYS, F. A. (Massachusetts Agricultural Experiment Station). Inbreeding the Rhode Island Red Fowl with Special Reference to Winter Egg Product-

tion. *The American Naturalist*, Vol. LVII, No. 654, pp. 43-59, tables 6. New York, 1924.

The expediency of inbreeding as a means of poultry selection is a very disputed, question ; many breeders being of opinion that the mating of nearly related birds leads to loss of vigour, lower hatching-out percentage and high mortality. It has been clearly proved that the uniformity resulting from inbreeding is due to the presence of homozygous factors, but not all of these characters are desirable. Inbreeding might be practised indefinitely without resulting in the slightest degeneracy, if breeders could begin with individuals that are homozygous for the desired characters, but owing to the great complexity of the modern breeds of fowls, the ideal can only be attained by means of a heterozygous type, which on being used as a starting point for the creation of a new breed, inevitably causes degeneration as soon as an attempt is made to bring together homozygous characters by means of inbreeding. The only way of reaching the uniformity which is the object of all breeders is by mating closely related birds. There appears therefore to be some definite opposition between uniformity and consanguinity on the one side, and the retention of the essential physiological characters on the other. The way to solve the problem is as follows : to obtain by inbreeding different strains of fowls that are not interrelated, but possess a high degree of uniformity in respect to the desired breed-characters. These various strains are then crossed together, and by this means uniformity is maintained and fresh vigour due to heterosis is introduced.

An inbreeding experiment with Rhode Island Reds was conducted in the spring of 1919, at the Massachusetts Experiment Station. The results given in the present report refer to chicks hatched in 1919, 1920 and 1921, of which the winter egg production could be noted.

The hens used in the experiment were pure-bred R. I. R. birds that had been selected for 6 years at the Station with a view to egg-laying. In 1919, hen No. B. 357 was mated to its son B. 3808. The second year, this fowl laid 173 eggs and was used in selection work for 4 years. For 6 generations there had been in the pedigree of this hen no common ancestor belonging to the cock B. 3808 and there was no relationship between the two birds. Hen No. 357 laid 286 eggs the first year ; 73 % of these eggs were fertile and their hatching coefficient was 63 %. The cocks were selected with the greatest care in order to insure the best individuals. All the hen chicks were tested by means of trap-nests in the course of the winter. The other birds used were the 2 sisters of B. 257, a hen of a very distant degree of relationship, and 4 others that were in no way related to B. 357. All the 5 last were one year-old birds and had been tested by means of trap-nests. The general plan adopted in mating was to concentrate the blood of B. 357. In 1920, one of its sons sired by a son was used ; in 1921, 2 sons sired by a son of this hen and two unrelated hens were employed for a control the first year. In 1921, the female progeny, which were sisters, were mated with their brothers. In table I, the author gives the results of mating cock B. 3808 with its mother, two of its own sisters

and a hen of more distant relationship. The control lot was composed of 4 hens entirely unrelated to B. 3808.

There was a general tendency for the egg-production of the daughters to fall below that of their mothers and this is explained by the fact that the mothers belonged to a selected lot that far exceeded their own sisters in the production of winter eggs. In some cases, the average egg-yield of the daughters was higher than that of their mothers, which is due to the introduction by the male parent of factors of high production.

The possible connection between the extent of inbreeding and the average winter egg production is interesting. The 25 inbred daughters of B. 3808 produced an average of 56.4 ± 17.50 eggs during the winter, whereas the 3 outbred daughters' average was 63.24 ± 15.675. Hence there is no great difference between the number of winter eggs laid respectively by the inbred and the outbred daughters. This proved that these two groups of hens have about the same genetic constitution for egg production. Unfortunately, it was not possible to make comparative tests in 1920-21 between the inbred and the outbred hens hatched in 1920 and 1921, because the cocks in the inbreeding experiment had not been mated to any unrelated hen. It is however quite clear from the data given in the authors' table that the average winter egg-yield of the mothers and daughters employed in the course of these two years had decreased with the progressive inbreeding. The length of the winter rest does not increase with the extent of inbreeding, but depends upon ordinary mendelian laws. The decrease of winter egg production in connection with the increase in the degree of inbreeding must be explained as a consequence of a decrease in the factors " early maturity " and " amount of winter production." In this case, the effect of inbreeding has been to render homozygous the factors favourable to high egg-yield. Evidently, the fowl used as the basis, although it had been judged satisfactory from its indiviudal characters, possessed certain factors which on being intensified by inbreeding, led to a fall in the production of winter eggs.

Body weight, which is frequently regarded as an index of vigour, underwent no degeneracy as a result of inbreeding as is shown by the author's table II, which gives the weights of the mothers and daughters at the time they laid their first egg. On the other hand it was found that with continued inbreeding, the fertility of the hens and the hatching percentage considerably declined, which was not surprising, seeing that hen B. 357 combined high fertility with low hatching percentage. Since 1923, Goodale and Sanborn have drawn attention to the fact that winter egg production in R. I. R. fowls depends on 5 chief characters : maturity, total amount of production, readiness to sit, persistence and winter rest. They term this winter rest a " partial moult ", because all cessation of egg-laying for a period exceeding one week is accompanied by a certain loss of feathers

The factor of early maturity has a great influence upon the egg yield. The author discovered a negative correlation of about 43 % between the age at which a hen laid its first egg and its egg production during the first year ; there was, however, a slight error which is probably due to a linkage of the factors, " early maturity " and " high yield ". It seems

clear that there is also a linkage between "extremely early maturity" and the presence of "partial winter moult". The results obtained show that the two factors E and E′ determine early maturity. Whether combined, or singly, each of these factors produces a fowl that begins to lay in 215 days or earlier. If both these factors are absent, the bird begins to lay later. The factor E is sex-linked, but E′ is independent. The great influence exerted by environmental factors upon early maturity must always be borne in mind. They may cause the age at which the fowl lays its first egg to vary from 160 to 215 days, and from 216 to 300 days. The cumulative effect of E and E′ has not yet been demonstrated, although it may well exist. It is seen from the results obtained that inbreeding tends to decrease early maturity.

With regard to "winter moult", there seems to be in R. I. R. fowls a close association between "rest for one week or more" in autumn and winter and "partial moult." The factor M which represents the genes of winter moult appears to exist independently, since by using hens that are hereditary non-sitters the defect of low winter egg yield can be remedied to a large extent; this might also be due to linkage between the factors of "early maturity" and "moulting".

The practical results given in the authors' table agree very closely with the theoretical results. A hen that is about to sit ceases laying for a time varying from some days to several weeks. GOODALE has not discovered any important correlation between the number of days of sitting and the annual egg yield. The oftener the hen becomes broody in spring and summer, the less the importance of this physiological phenomenon from the standpoint of winter egg production. It has been found that, in the case of Rhode Island Reds, the total egg production is higher in lines with a high percentage of broodiness than in those where the hens show little inclination to sit. This is, however, no proof of a linkage between "sitting factor" and "egg production". According to GOODALE, there would appear to be two factors, *A* and *C*, that determine sitting; their existence has indeed been proved by this experiment. The combined action of both these factors is necessary to induce sitting. The males and females can only possess one of these factors respectively which are reunited by the union of the cock and hen with the result that a good sitter is produced. Table V shows the close agreement between the actual and the theoretical results.

The winter egg yield is calculated for each hen by dividing the number of eggs laid before March 1 of the year in which the pullet was hatched by the number of days intervening between the laying of the first and the last egg. A "large number" means 50 % or over, viz., one egg every two days during the winter. The facts would seem to show that there are two dominant, independent factors which determine high egg production, viz. R and R′ and the presence of both is necessary in order to obtain over 50 %. These two factors seem to be connected with the amount of production in the same way as A and C are related to capacity for sitting. The author's table VI shows the agreement between the found and the theoretical grouping. Hen B. 357 appears to be homozygous as regards B

and heterozygous as regards B'. It must be borne in mind that in order to know the genetic formula of a bird it is necessary to test the performance of its progeny. By means of careful testing, it is possible to obtain lines of fowls that are genetically pure for the factor of " high egg yield ".

The author takes as his basis the various data that have just been set forth and gives the probable genetic formulae of the fowls used as the founders of the race in this experiment. These formulae are already very complicated, although some of the factors referring to winter egg production have not yet been determined by the inbreeding test, and they show the difficulty of obtaining genetically pure groups.

The following conclusions can however be drawn from this experiment :

(1) Inbreeding reduces the variability in winter egg production, provided the R. I. R. fowls are to a great extent homozygous as regards the factors of high yield.

(2) Sexual maturity appears to be hindered by inbreeding.

(3) Inbreeding appears to have no effect upon the weight of the birds.

(4) When the amount of inbreeding exceeds 25 %, it seems to lessen winter egg production. In fact a cumulative effect in the course of several generations may be observed.

(5) Winter egg production probably depends on 7 pairs of Mendelian factors. The creation of pure lines as regards these factors is possible if proper means are adopted for the purpose. P. D.

694. **Effect of Age on the Hatching Quality of Eggs.**

LENONCIO, M. O. *The Philippine Agriculturist*, Vol. XII, No. 8, pp. 349, tables 3. Los Baños, Laguna, 1924.

The author, basing his work on the results of the experiments carried out in the United States by LAMSON and KIRKPATRICK, WAITE and DRYDEN, made a study under the conditions obtaining in the Philippines of the following : 1) the maximum period during which eggs for hatching can be kept ; 2) the best age for setting eggs in order to obtain most chicks at least cost ; 3) the best time of year for hatching. The experiments conducted at the Agricultural College of the University of the Philippines at Los Baños were begun in December 1921, and concluded in August 1922. The eggs came from Barred Plymouth Rocks and Canton fowls, and were hatched under hens. As soon as it was certain that a hen wished to sit, she was given a dozen eggs all alike in size, shape and shell structure. These eggs had been kept in a dry, well ventilated case ; the date of laying was written in red ink on each egg. Under each sitting hen were placed 3 recently laid eggs ; 3 five days old, 3 ten days old and 3 a fortnight old. The eggs were inspected on the seventh and the fourth day after they had been put under the hen. The sitting hens were given maize and whole rice and had free access to water and to a bath made of 2 parts dust and one part lime. At first the hens were lifted from their nests, morning and evening, at feeding time and put back on the nest after 20 minutes, but from the 19th day of incubation, they were no longer allowed to leave

Effect of age of eggs and of the incubation season upon hatching.

Age of eggs	December, January, February					March, April, May					June, July, August				
	Number of eggs set	% infertile eggs	% dead eggs	% hatchings: in relation to total number of eggs	% hatchings: in relation to number of dead eggs	Number of eggs set	% infertile eggs	% dead eggs	% hatchings: in relation to total number of eggs	% hatchings: in relation to number of dead eggs	Number of eggs set	% infertile eggs	% dead eggs	% hatchings: in relation to total number of eggs	% hatchings: in relation to number of dead eggs
Table I. — *Hatching results with Canton eggs.*															
Fresh	44	11.3	15.3	75.0	92.3	93	12.9	18.5	71.0	81.5	24	4.2	31.7	75.0	78.3
5 days	43	30.2	16.6	58.1	83.3	73	17.2	37.6	51.6	62.3	24	4.2	43.4	54.1	56.5
10 days	43	34.9	17.8	53.5	82.1	93	30 1	80.0	14.0	20.0	24	8.4	54.5	41.6	45 5
15 days	50	62.5	53.3	17.5	46.6	93	35.5	93.3	4.3	6.7	24	25.0	100.0	0	0
Table II. — *Hatching results with Barred Plymouth Rocks.*															
Fresh	36	16.7	13.3	72.2	86.7	42	16.7	22.8	64.3	77.1	9	22.2	14.2	66.7	85.7
5 days	36	27.7	19.2	58.3	80.7	42	19.0	47.0	42.9	52.9	9	22.2	57.2	33.3	42.8
10 days	36	38.8	31.8	41.7	68.2	42	42.9	79.1	11.9	20.8	9	22.2	71.4	22.2	28.5
15 days	35	51.4	58.8	20.0	41.2	42	45.2	82.6	19.5	17.4	9	11.1	100.0	0	0
Table III. — *Hatching results obtained from eggs of Canton hens and Barred P ymonth Rocks.*															
Fresh	80	14.0	14.3	73.6	89.1	135	14.8	20.6	67.7	79.3	33	13.2	17.9	60.4	71.1
5 days	79	29.0	17.9	58.2	82.0	135	18.1	42.2	47.3	57.6	33	13.2	50.2	43.7	49.7
10 days	79	36.9	24.8	47.6	75.2	135	36.5	79.5	13.0	20.4	33	15.3	62.9	31.9	37.0
15 days	75	57.0	56.1	18.8	43.9	135	40.4	87.9	6.9	12.1	33	18.1	100.0	0	0
Meteorological data for the 3 experiments	Average temperature 24.4° C. Rainfall 111.4 mm. Average speed of wind 610.4 miles.					Average temperature 27.9° C. Rainfall 358.7 mm. Average speed of wind 652.5 miles.					Average temperature 26.4° C. Rainfall 705.5 mm. Average speed of wind 546.5 miles.				

their nests. During the course of the experiment, meteorological observations were made by the Botanical Department of the College of Agriculture. The experiments, which were divided into 3 periods each lasting 3 months, gave the results shown in table 3.

The percentage of infertile eggs as given in the tables was obtained by dividing the number of infertile eggs detected during the first inspection by the total number of eggs set and multiplying the quotient by 100. In the same way, the dead eggs include the eggs found to contain dead embryos at the time of the first and second inspection, as well as those that failed to hatch. The percentage of dead eggs was obtained by dividing the total number of dead eggs by the number of fertile eggs and multiplying the quotient by 100. The results were practically the same for both breeds. The percentage of infertility rises with the length of time the eggs are kept before incubation, independently of the season. The best results are obtained by setting newly-laid eggs. The most satisfactory months for hatching appear to be December, January and February, which must be due to the better condition of health of the hens at this time owing to the lower temperature and the abundance of green food rich in protein, all these conditions having a favourable influence on the quality and fertility of the eggs laid at this season.

The evaporation of the water in the eggs, which increases with the time they are kept, and the rise of the external temperature, has a very injurious effect upon the vitality of the germinal vesicle of the egg. During December, January and February, the maximum time eggs for hatching can be kept is two days ; in the warm months, the eggs must be set when fresh. The small number of eggs that hatch out in warm weather is probably also to be attributed to the fact that the sitting hens often leave the nests for a time so that the clutch gets chilled. P. D.

695. **The Domestication of the " Jao " Fowl (*Crypturus noctivagus*) in Rio Grande do Sul.**

Gallinhao de ovos azues no Rio Grande do Sul. *Chacaras e Quintaes*, Vol. 29, No. 3, p. 233. São Paulo, 1924.

The recording of the indigenous fowls of Chile which are without combs or tails and lay blue eggs aroused great interest (1). The same characters are presented by the " jao " (*Crypturus noctivagus*), which is native to various States of Brasil (2), among others in Rio Grande do Sul, but is easily domesticated and reared here and there promiscuously with common fowls.

Systematic attempts to form a domestic race of this valuable fowl should be entrusted to the " Sociedade de Avicultura do Rio Grande do Sul " which has headquarters in Pelotas and is starting a " Posto avicola ". F. D.

(1) This refers to the species shown at the World's Congress of aviculture at The Hague (1921), which there received the name of *tinamus tao*. See *R.* 1923, No. 804. (*Ed.*)

(2) For Matto Grosso see *R.* 1924, No. 298. (*Ed.*)

Sericulture.

696. **Etiolated Leaves and Cotyledons Refused by Silkworms.**

LOMBARDI, L. Mangiano i bachi foglie di gelso prive di clorofilla e foglie cotiledonari ? *Bollettino della R. Stazione Sperimentale di Gelsicoltura e di Bachicoltura di Ascoli Piceno*, Year III, No. 3, pp. 127-128. Ascoli Piceno, 1924.

The author found that very young silkworms would die of hunger rather than eat the cotyledons of the mulberry. He repeated the experiment with silkworms of different ages and breeds, but obtained the same result. Evidently the cotyledons of the mulberry are unsuitable as food for silkworms.

Subsequently, the author made various experiments with etiolated leaves. Mulberry seeds were allowed to germinate in the dark and the etiolated cotyledons were fed to silkworms, but the larvae refused to eat them, and also rejected the etiolated leaves of mulberry-trees that had been put in a dark place before the leaf-buds had unfolded.

Some normally developed mulberry plants bearing leaves of a rich deep colour were placed in the dark until etiolation set in, but although the leaves lost their colour, some green portions still remained in the neighbourhood of the chief veins. The caterpillars ate these leaves, but showed a marked preference for the greener parts.

The author then prepared an alcoholic solution of chlorophyll and after diluting it with water, in order to induce the precipitation of the chlorophyll and the other substances in solution, sprinkled the etiolated leaves with the mixture. The leaves thus treated were eaten by the caterpillars as readily as normal leaves. The silkworms however refused to eat the etiolated leaves of the lime, red clover, and paper mulberry (*Broussonetia papyrifera*) even after they had been sprinkled with chlorophyll extract.

It therefore appears that the presence of the chlorophyll pigment is necessary in order that mulberry leaves should be acceptable to silkworms. The author discovered that in cases of chlorosis, the chlorophyll has undergone considerable alteration but is not absent, which explains the fact that silkworms do not refuse to eat chlorotic leaves. P. D.

697. **Rearing Silk-Worms in Tobacco-Drying Sheds.**

LOMBARDI, L. Si possono allevare i bachi nei locali di essicazione per il tabacco ? *Bollettino della R. Stazione Sperimentale di Gelsicoltura e Bachicoltura di Ascoli Piceno*, Year III, No. 3, pp. 121-123. Ascoli Piceno, 1924.

With a view to profiting by the advantages offered by the spacious, well-ventilated sheds used for drying tobacco, the author conducted experiments to determine the resistance of silkworms to tobacco dust disseminated in the air by means of a sprayer. Pure tobacco dust proved very injurious, but silkworms can easily stand a mixture of tobacco dust (5 %) and starch powder. The rate of mortality was very low when this mixture was employed. Since only traces of tobacco dust remain in the

tobacco drying sheds after they have been well cleaned, it would appear, on the strength of the author's experiments and the evidence of trustworthy witnesses, that such premises could well be used for silkworm rearing, provided that they were not only subjected to the usual disinfection, but were also carefully freed from all tobacco dust and the walls of the sheds whitewashed.

P. D.

698. **The Condition of the Silk Industry in Algeria.**

L'état de la sériculture en Algérie. *Les cahiers coloniaux de l'Institut colonial de Marseille*, No. 269, pp. 138-139 Marseilles, 1924.

It was in 1843 that the first attempts at silkworm rearing were made at the central nursery. Thanks to the encouragement of the Government who, since 1848, bought the cocoons produced by the local silkworm breeders, the silk industry acquired importance and reached its maximum in 1853, with a production of 13,319 kg. of cocoons. Numerous silkworm nurseries were established, plantations of mulberry trees made and several silk spinning factories installed. Since that time, the importation of foreign cocoons, the fall in prices and infectious diseases have caused the Algerian silk industry to decline rapidly.

On several occasions attempts were made to re-establish this production. The Government of Algeria published numerous notes on the silk industry; the Law of 13 January 1892, and later that of 11 June 1909, applicable to Algeria, instituted a premium of 60 centimes per kilogramme of raw cocoons in favour of the silkworm breeders. The Paris-Lyon-Méditerranée Company, in order to encourage silkworm rearing by indicating the regions where the mulberry could grow, planted mulberries along the Algiers-Oran line in 1906. At the same time a planter of Blida, M. Louis MARQUINES, carried out several silk-growing experiments, both on the mulberry silkworm and also on other silk-worms living on castor-oil plant, ailanthus, oak, quince, jujube tree, medlar and service-tree and stated that he obtained excellent results with wild or semi-wild broods.

Although it had been shown that silk production is possible in Algeria, cocoons of good quality can be produced, average yields of 40 kg. per ounce of eggs can easily be reached, and there is nothing to prevent 3 broods a year, the production of silk has never been able to establish itself on a firm basis in the Colony and the native population has always shown itself reluctant to undertake it.

In 1915 there were in the Colony 32 110 mulberry trees; the total quantity of silkworm eggs put to incubate in the same year was 41 hectogrammes, which produced 1430 kg. of cocoons. Since 1921 no application for premiums for sericulture has been made to the Algerian Administration.

F. D.

FARM ENGINEERING.

Methods of Cultivation.

699. **First Experiments in Ploughing without Turning the Furrow in Algeria (1).**

Premiers essais de labour sans retournement en Algérie. *Bulletin de l'Office du Gouvernement Général de l'Algérie*, Year 30, No. 2, p. 33. Paris, 1924.

M. BORIES, " President de la Confédération des Agriculteurs d'Algérie ", has started experiments in the method of " breaking up " the soil and the results of his first attempt are as follows.

The experiment was conducted with a two-share plough from which the mouldboard hed been removed. It was found that the depth of ploughing could be increased 6 to 7 cm., and also that the soil was pulverised and contained no clods. The plants and their roots were almost completely dislodged. so that cleaning the soil with the harrow became an easy matter. It must, however, be admitted that the widened frame caused the soil to be turned to a certain extent. The resistance was great on account of the roughness of the mouldboard-rest which prevented the share sliding easily. R. D.

700. **An Electrical Method for Reduction of Draught in Ploughing.**

CROWTHER, E. M. and HAINES, W. B. (Rothamsted Experimental Station). *Journal of Agricultural Science*, Vol. XIV, Part. 2, pp. 221-230, figs. 6. Cambridge, 1924.

A large fraction of the work done in ploughing arises from the friction between the mouldboard and the soil, the amount haoing been estimated at one third.

The authors propose a simple electrical method for the reduction of this friction, based upon the phenomenon of electroendosmose which is shown by moist soil. Soil colloids are negatively charged, and water will move through moist soil towards the negative electrode under the action of the electric current. It is suggested that, if a current be passed through the soil having the mouldboard of a plough as negative electrode, then the film of water formed at the soil-metal surface should act as a lubricant and reduce ploughing draught.

Large reductions were obtained in laboratory tests with a metallic slider moving over moist soil.

Preliminary tests showed that the draught of a plough is reduced by applying a current between the coulter and the mouldboard. The amount of reduction in draught obtained in the field experiments was too small to have any practical significance, as the gain would be outweighed by the cost of generating the electricity, but the possibilities of the suggestion are under consideration. W. S. G.

(1) See *R.* 1923, No. 3. Ploughing without turning the furrow in Austria. (*Ed.*)

701. **Field and Pot Experiments in Electro-Culture.**

I. — BLACKMAN, V. H. (Imperial College of Science and Technology London). *Journal of Agricultural Science*, Vol. XIV, Part 2, pp. 240-247, Bibliography. Cambridge, 1924.

II. — BLACKMAN, V. H. and LEGG, A. T. Pot-Culture Experiments with an Electric Discharge, *Ibid.* pp. 268-286, Figs. 3, bibliography.

I. The author gives a brief account of the history of electro-culture from the time of the first experiments carried out by MAMBRAY at Edinburgh in 1746 to the present day.

Details of the field experiments carried out on cereals and clover from 1915 to 1920 are given, the results of which are set out below:

Spring-sown Cereals.

			Difference between yield of electrified and control areas difference	%
Lincluden	1915	Oats	+ 4.8 bus. per acre	+ 30
»	1916	»	+ 11.2 » » »	+ 49
»	1917	»	+ 0.7 » » »	+ 2
»	1918	»	+ 26.7 » » »	+ 50
»	1919	»	+ 12.8 » » »	+ 33
»	1920	»	— 2.6 » » »	— 6
»	1920	»	+ 18.8 » » »	+ 57
Rothamsted	1917	Barley, small plots	(+ 5.3) » » »	(+ 36)
»	1918	» » »	+ 4.4 » » »	+ 19
»	1920	» » »	— 5.1 » » »	— 19
Harper Adams College	1919	Oats	+ 1.0 » » »	+ 2
	1920	»	— 4.3 » » »	— 9
		Mean	+ 7.1 » » »	22 %

Winter-sown Wheat

Rothamsted	1919		+ 6.0 » » »	+ 38
»	1920		— 9.7 » » »	— 14

Clover-Hay

Rothamsted	1919	1st Crop	+ 11.7 cwt. per acre	+ 50
»	1919	2nd »	+ 4.3 » » »	+ 34
Harper Adams College	1920	1st »	+ 0.5 » » »	+ 2
» »	1920	2nd »	— 3.0 » » »	— 4
		Mean	+ 3.4 » » »	+ 20 %

These results, together with the record of the pot-culture experiments put forward in the second paper, and laboratory studies, provide evidence — from the field, from pot-cultures and the laboratory — of the effectiveness of minute electric discharges in the stimulation of the growth of plants.

The discharge was usually given at the rate of 0.5 to 1.0 milliamp. per acre from thin wires stretched above the crop at a height of about 7 ft. and charged to a voltage of 40 000 to 80 000. The discharge was usually given for 6 hours a day in two periods of 3 hours in the morning and 3 in the afternoon.

Of 18 experiments with various crops, 14 gave positive results in favour of the electrified plots and 4 gave negative results. The positive results showed increases of from 3 to over 30 %. With spring-sown cereals 6 results are recorded of increases of 30 to 57 %, whereas the two negative results are only 6 and 9 %.

It is improbable that the mean increase yield of 22 % is the limit that may be obtained with spring-sown cereals.

In several cases the electrified field-crops showed a deeper tint than that of the controls. The effect of the discharge is in the nature of a stimulus, as the additional available energy from the current is too small to have any direct effect. There is no evidence that gaseous products of the discharge play any part in the stimulation of growth.

II. The previous paper deals with the results of field-experiments, in which, although the increased yields were very definite, the probable error may be large, and the authors recognized the necessity of carrying out experiments to study the effect of varying conditions. Owing to the large number of factors involved the time occupied by field-experiments would be great, whereas in pot-culture experiments the probable error can be reduced to 2-3 %, and significant results can be obtained in a single year; hence the decision to adopt this method of investigation. The experiments ran concurrently with those in the field and were carried out at the Rothamsted Experimental Station from 1918 onwards.

A summary of the results obtained is as follows: — The experiments carried out over a period of four years with wheat, barley and maize show that these plants show increase in dry weight when subjected to minute electric currents from wire network charged to a high voltage suspended above them.

Maize plants grown under glass showed a percentage increase in dry weight of 27 ± 5.8, and barley of 18 ± 2.4.

Increased growth was obtained with both direct and alternating current, the latter being as effective or even more so than direct.

Electrification of barley for the first month of the growing season appears to be as effective as electrification during the whole growing season.

The discharging net-works were usually charged *positively* but a similar stimulating effect on dry weight production was obtained with a negative charge.

Currents of the order of 1×10^{-8} amp. per plant and higher are injurious, and cause reduction of dry weight.

The pot-culture experiments are in conformity with those from the field and the laboratory, and leave no uncertainty as to the favourable action of the electric discharge.

W. S. G.

702. Electrocultural Experiments in Italy.

MUNERATI O. [Direttore della R. Stazione di Bieticoltura di Rovigo]. Esperienze di elettrocoltura. Primi rilievi con metodo delle antenne Paulin. *Annali dell'Agricoltura*, Year IV, No. 1, pp. 79-86, Rome, 1924.

By means of the PAULIN antennae method, the author electrified the sugar-beets growing on a plot of 185 m. × 46 m. and found as a result of careful experiment, that these roots had a higher average weight and mean saccharose content than the sugar-beets cultivated on the control plots. The increases were greater in plots with underground wires (average weight 261 gm., mean saccharose percentage 14.38 %, as against 223 gm. and 14.01 %, for the check plot) than in the plots with overhead wires (237 gm., 14.71 % saccharose as against 235 gm. and 14.15 % for the check plots). The author does not, however, consider these experiments conclusive and intends continuing them.

F. D.

Machines and Implements.

703. A Treatise on Modern Farm Machinery.

MACHARDY, D. N. *Modern Farm Machinery* with a preface by M. J. R. DUNSTAN. London, Methuen & Co Ltd., 1924; pp. XVIII + 235, 157 diagrams and illustrations.

Mr. DUNSTAN, Principal of the Royal Agricultural College, Cirencester, in his introduction, sketches concisely the place of machinery in modern agriculture and adds "The book deals mainly with mechanical aids to production and to a certain extent with transporting machinery, and is of considerable value, as it is written by one who has had an extensive practical experience of working with agricultural machinery, and so can envisage the matter from the farmer's point of view".

The object of the book is to "set out in plain language the principles of construction, the uses and the operation of modern types of machinery in use on farms to-day".

It covers the following topics:— mechanical principles employed in farm machinery — the plough and its operation — drainage machinery — cultivators, harrows, rollers — rotary tilling — seeding machinery — artificial manure distributors — root-growing machinery — grass mowers — hay harvesting machinery — the reaper and binder — stationary motors for farm work — barn machinery — the cream separator — threshing machines — ensilage cutters — elevating and conveying machinery — pumps and spraying machinery — farm transport — electricity on the farm — the farm workshop.

In the appendices useful data are collected, and the book concludes with an analytical index.

F. D.

704. Two-way Tractor Plough.

CASE T. M. Co. *Farm Implement News*, Vol. 45, No. 12, p. 20, figs. 2. Chicago, 1924.

This article gives information respecting a new two-way plough manufactured by the J. J. Case Threshing Machine Co., Grand Detour Plough Division, Racine, Wisconsin, U. S. A. and shewn at fig. 108. This plough is intended for use on irrigated fields, which it keeps properly contoured, and possesses two independent plough bottoms that the driver of the tractor can couple and uncouple from his seat.

R. D.

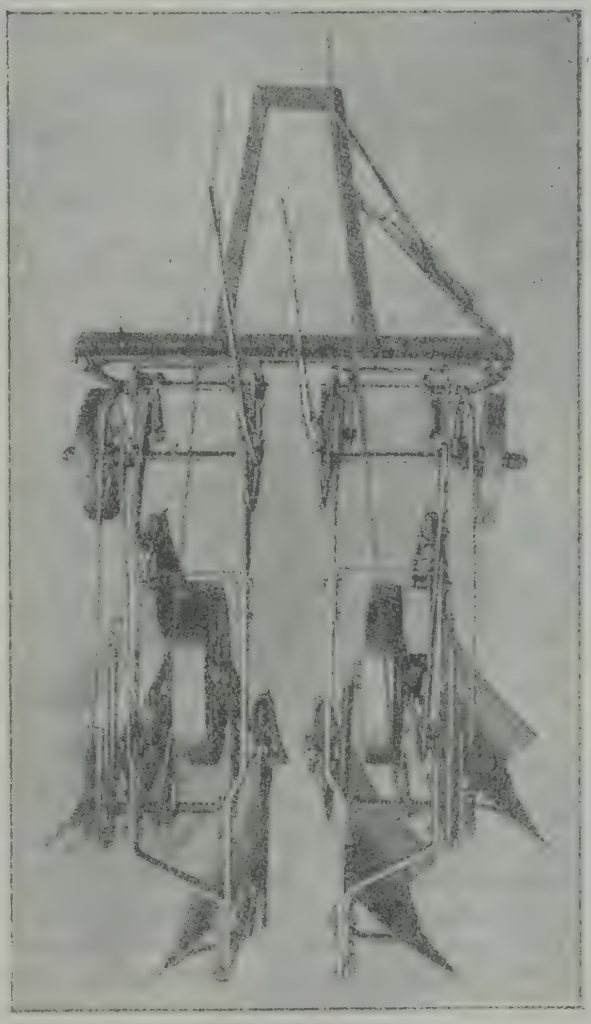

FIG. 108. — Plough for "Two-Way" Tractor, for ploughing on the flat.

705. Alternating Inter-Vine Cultivator.

CARRÉ, A. (Directeur honoraire des Services agricoles). *Progrès agricole et viticole*, Year 45, No. 17, No. 17, pp. 403-405, figs. 2. Montpellier, 1924.

This apparatus in intended to simplify hand-labour in vine yards. It consists of a machine that allows two working pieces in the form of movable, horizontal knives *A* and *B* to cultivate alternately all the unhoed space between the vines that has been left untouched by the part which works normally (Fig. 109).

As soon as part *B* (fig. 110) makes the slightest contact with a vine-stock, it pivots upon itself to take up position *B*. During this time, the blade *A* works the ground left untouched by *B* until such time as it comes into contact with the next vine-stock, when it pivots in its turn. This continues until all the space between the rows is worked by the pas-

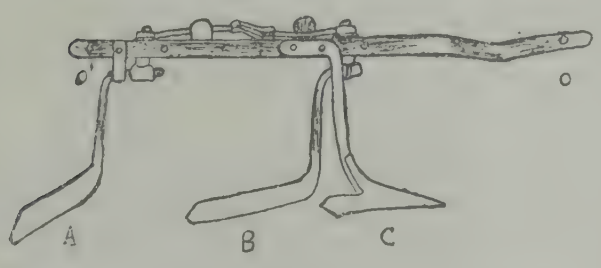

FIG. 109. — Alternating vineyard cultivator (front view).

sage of the instrument. The author has tested this apparatus (manufactured by the firm of Jean, Carcassonne, France) adapted to a small ordinary cultivator and obtained good results, even in vineyards where the soil contained many stones. The slightest resistance of a vine-prop, or of a vine-stock more than 3 years of age caused the working-pieces to pivot in such a manner that none of the vines suffered any injury. This new apparatus is, however, best suited to well-cultivated vineyards with loose soil containing but few stones.

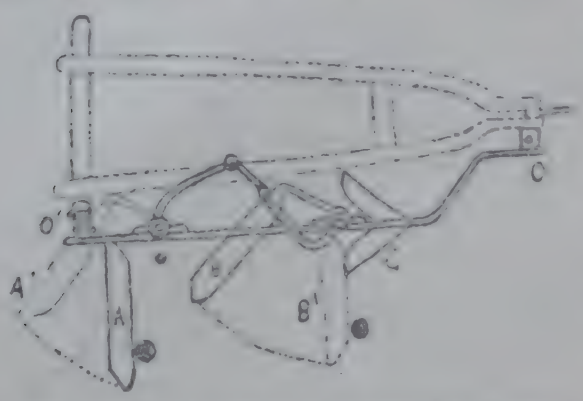

FIG. 110. — Alternating vineyard cultivator (surface view).

R. D.

706. **A Machine for Cutting Potato Haulms.**

Une machine à couper les fanes de pommes de terre. *La Terre Vaudoise*, Year XVI, No. 21, p. 331. Lausanne, 1924.

When potatoes are grown on a large scale and harvested by machine, the strong green haulms give a great deal of trouble if the potatoes are lifted before the plants are completely mature. A Scottish manufacturer (David WILSON, East Lindon, near Prestonkirk) has made a special mower drawn by one horse and provided with a cutting-bar that mows off the haulms on two rows, putting them on one side. R. D.

707. **Sugar-Beet Lifter.**

The Implement and Machinery Review, Vol. 50, No. 589, pp. 69-72. London, 1924.

A descriptive and critical study, with illustrations, of the various types of beet-lifters at present on the market. R. D.

708. **The Effect of Threshing upon Wheat.**

MUNERATI, O. Sur les conséquences du battage du blé. *Comptes Rendus de l'Académie d'Agriculture de France*, Vol. X, No. 15, pp. 469-473. Paris, 1924.

Many experimentalists in different countries have studied the question of the percentage of grains that are injured by mechanical threshing, but the figures given vary considerably, ranging from 2 to 4 % in MUNERATI's experiments in 1902 and 20 to 26 % in experiments made in Switzerland.

In later experiments made in Italy MUNERATI always obtained the low percentages recorded for 1902 and these results were confirmed by the observations of TODARO, STRAMPELLI and BASSI. It thus appears warrantable to conclude that the injury sustained by Italian seed wheats from machine threshing is practically negligible.

The solution of the problem evidently differs according to the case, but the author hopes that by means of special researches made throughout the country with the collaboration of other workers, and under the auspices of the " Académie d'Agriculture de France ", some further and more definite light on the question may be obtained.

M. Jacques DE VILMORIN says that the different rates of threshing may be one of the causes of the variations in the number of grains that are broken during threshing operations. F. D.

709. **Apparatus for Removing Seeds of Dodder and Plantain.**

COUPAN. Décuscuteuse-déplantineuse, *Recherches et Inventions*, No. 15 (New Series), pp. 549-550. Paris, 1924.

When the seeds of Leguminosae have been thoroughly threshed, it is difficult to free them entirely from the minute seeds of parasites like the dodder, or from weed-seeds like those of the plantain which closely resemble the legume seeds both in shape and size.

G. DUVAL has observed that the testae of plantain and dodder seeds are easily ruptured and cannot resist the threshing operation (" ébourrage ") which detaches the inflorescences from the stalks; they therefore can be removed without difficulty before the dried testae are winnowed from the seeds. For this purpose, M. DUVAL has made a truncated sieve provided round the edge with holes to receive the leguminosae seeds which are freed from the seeds of parasites together with the small number of seeds that have been shelled, and then pass on to have their testae removed. A rotating brush cleans the holes of the sieve. R. D.

710. **Experiments in Milking Cows by Machinery.**

BERGE R. Expériences sur la traite mécanique des vaches. *Comptes rendus del'Académie d'Agriculture de France*, Vol. X, No. 11, pp. 372-375. Paris, 1924.

The Alfa Laval milking machine was tested on 16 cows at Vaulx-de-Cernay. The results obtained formed the subject of a paper written by M. de ROTHSCHILD and laid before the " Académie " by the author.

None of the cows objected to the machine; 11 allowed themselves to be thoroughly milked; 5 kept back their milk either partially or entirely. In the case of the first 11 cows, 4.58 % of the total amount of the milk in the udder was drawn by hand-stripping in the morning and 5.58 % in the evening. This milk contained 2 to 6 times more fat than the milk obtained by means of the machine. Machine milking, if the time required for hand-stripping afterwards is added, takes twice as long as milking entirely by hand. A cow-keeper can easily supervise 4 machines; changing the cow, hand-stripping, weighing the milk and pouring it into other receptacles takes only 3 minutes. By machine milking followed by hand-stripping, a little more milk is obtained than if the whole operation were carried out by hand. F. D.

AGRICULTURAL INDUSTRIES.

Plant Products.

711. Causes Affecting the Ripening of Grapes and the Composition of Wines.

CARPENTIERI, F. (R. Enotecnico presso il Ministero dell'Economia Nazionale). Delle cause che influiscono sulla maturazione dell'uva e sulla composizione dei vini. *Nuovi Annali dell'Agricoltura*, Year IV, No. 1, pp. 166-191. Rome, 1924.

The composition of Italian wines varies within much wider limits than that of the wines of other countries where the vines are cultivated under more uniform conditions. The alcohol content, for instance, ranges from 4.5 to 24.2 %, in volume, the latter figure including the potential alcohol.

The composition of the grapes, and hence the quality of the wines made from them, depend on (1) the vine; (2) the environmental conditions of cultivation; (3) the system of cultivation adopted and the manner in which it is carried out. The author examines these three factors and their effects, using for the purpose a very large amount of material including the results of 91 thousand analyses of wines. F. D.

712. Experimental Milling and Baking Tests in the United States (1).

SHOLLENBERGER, J. H., MARSHALL, W. K., and COLEMAN, A. *United States Department of Agriculture, Bulletin* No. 1187, pp. 1-53, tables 3. Washington, 1924.

This Bulletin contains descriptions of the method of handling and analysing the samples received for milling and baking tests; the experimental mill and its operation, the baking laboratory and the methods employed, the equipment and methods of analysis used in determining the chemical constituents of grain and mill products. The milling and baking laboratory is maintained by the Bureau of Agricultural Economics (U. S.) for the purpose of testing the required quantities of wheat, rye and other grains, and of determining the relationship between these qualities and the physical and other factors which should be useful in grading the grain. M. L. Y.

713. The Extraction of Potato Starch without Loss of Nutritive Substances.

Dr. HANSEN, I. and Dr. DIETRICH, W. (Institut für Tierzucht der Landwirtschaftlichen Hochschule) Stärkegewinnung aus Kartoffeln ohne Verlust an Nährstoffen. *Mitteilungen der Deutschen Landwirtschafts-Gesellschaft*, Part 19, pp. 352-356, figs. 2, tables 8. Berlin, 1924.

The usual method of extracting starch from potatoes has the disadvantage from the stock-feeding standpoint, that a large part of the nutri-

(1) See *R.* 1924, No. 433. (*Ed.*)

tive elements, especially of the nitrogenous compounds, is lost in the washing. As compared with the distillery pomace, the pulp is very poor; when fresh, it contains crude fibre 0.4 %, N-free extracts 9.5 % and 9.4 % starch value. About 2.1 % of crude protein is present on an average in potatoes, but this is removed by the washing process.

All these objections however seem to be removed by the machine which is shewn by Messrs KÜERS (Berlin-Tegel).

The potatoes, after being well washed, pass into hopper A beneath which a cylinder fitted with knives revolves very rapidly. The crushed potatoes are mixed in vessel B with water coming from the reservoir C. B is composed of an inclined trough in which a sieve with 6 sectors moves slowly. Owing to the inclination of the sieve the crushed potatoes lose their water at the top of the sieve and take it up lower down. Thus the starch is extracted in 15 to 20 minutes. This apparatus, which can treat 75 to 100 kg. of potatoes per hour, only requires a force of 0.8 kw. (Fig. 111).

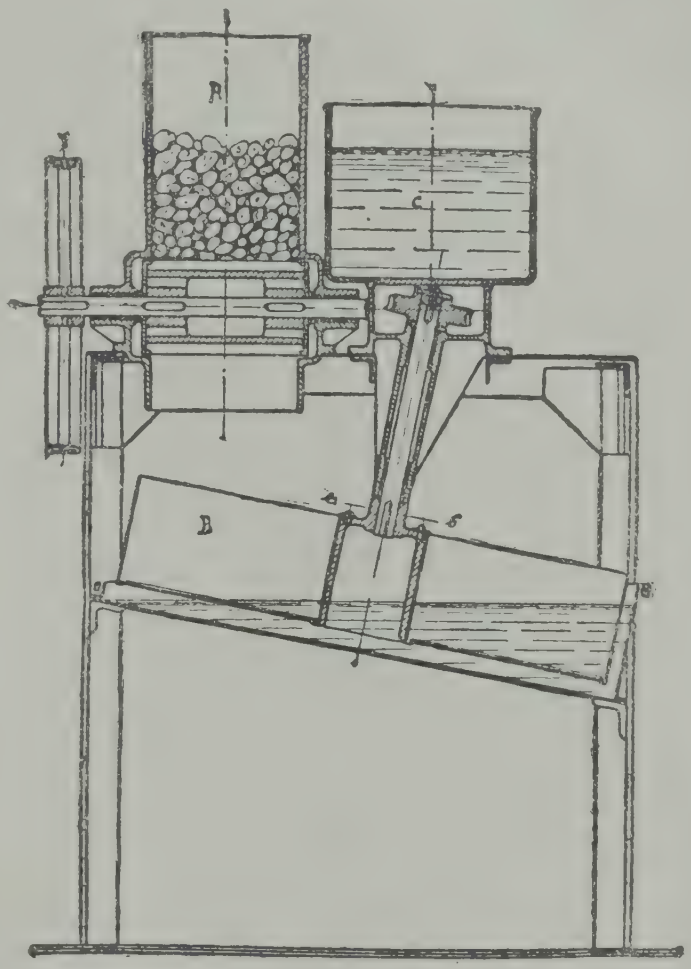

FIG. 111. — KÜERS apparatus for the extraction of potato starch.

DIETRICH has made experiments to ascertain the output of the machine and to see how the different nutritive elements in a given quantity of potatoes are distributed among the products.

25 kg. of potatoes are crushed in 6 minutes ; the apparatus is allowed to work for 20 minutes. While the sieve is actually revolving, the tap which allows the starchy water to run off is turned. The starch is deposited in a few hours. After the apparatus has been allowed to revolve for some minutes with the tap open, the pulp is removed from the sieve.

The results obtained are summarised in the following tables.

Experiment A (*Potatoes poor in starch, extraction water used once only*)

Percentage composition of the moist substance.

	Potatoes	Pulp	Residual water
	—	—	—
Dry matter	21.66	12.43	2.57
Mineral matter	0.96	0.46	0.40
Organic matter	20.70	11.97	2.17
Crude protein	2.00	0.99	0.84
Albuminoids	1.41	0.67	0.50
N–free organic matter	18.70	10.58	1.33
Starch	14.50	—	—

Experiment B (*Potatoes richer in starch, extraction water used 4 times in succession*).

Percentage composition of moist substances.

	Potatoes	Pulp	Residual water	Residual water of extr. 3.
	—	—		—
Dry matter	24.02	15.38	3.18	2.79
Mineral matter	0.95	0.73	0.69	0.62
Organic matter	23.07	14.65	2.49	2.17
Crude protein	1.52	1.13	1.09	0.97
Albuminoids	1.05	0.80	0.79	0.73
N–free organic matter	21.55	13.52	1.40	1.20
Starch	18.2	—	—	—

Results of experiments A, B, C (the object of C was to determine the minimum of water that could be used).

Experiment		Potato content in			From 100 kg. of potatoes were extracted (starch)		Nutritive ratio		Amount of water used for 100 kg. potatoes
		dry matter	crude protein	starch %	dry starch kg.	% of total starch	potatoes	pulp + residual water	
A	1	21.66	2.00	14.5	7.3	50.3	1 : 9.4	1 : 5.5	150
	2				8.2	56.2		1 : 5.3	144
B	3	24.02	1.52	18.2	9.6	52.7	1 : 14.2	1 : 4.4	220 (80)
	4				10.7	58.8		1 : 3.0	(1) 200 (75)
C	1	21.74	1.27	15.6	7.1	45.5	1 : 15.2	1 : 8.6	101
	2				7.5	48.1		1 : 6.5	(1) 173 (100)
	3				7.6	49.0		1 : 8.8	120

(1) The figures in brackets show the average amount of water used for all the extractions of the same series, whereas the figures beside them give the total amount of water used in the special test under consideration.

The experiments show that with this particular machine it is possible to extract at least half the starch contained in the potatoes while all the important nutritive substances are collected in the pulp and the residual water. R. D.

714. Extraction of Oil from the Pulp and Kernels of Oil Palm Fruits.

I. — ABEELE VANDEN (Ingénieur agricole. Note relative à la fabrication industrielle de l'huile de palme. *Bulletin des Matières Grasses de l'Institut Colonial de Marseille*, No. 3, pp. 71-73. Marseilles, 1924.

II. — CHALOT, C. L'extraction de l'huile de palme par dissolvant. *L'Agronomie Coloniale*, Year 10, No. 75, p. 85, Paris, 1924.

III. — Procédé et appareil pour l'extraction de l'huile de palme. *Bulletin des Matières Grasses de l'Institut Colonial de Marseille*, 1924, No. 2, pp. 48-53. Marseilles, 1924.

IV. — COUPAN. Concasseur Trieur d'Amandes de palmiste. *Recherches et Inventions*, No. 15. (New Series), pp. 548-549, figs. 2. Paris, 1924.

I. — The author first enumerates the causes producing an increase in the free acid content of palm oil and describes the defects in the wet (native method and HAAKE method) process of preparing the oil. He then indicates the advantages of heating the pulp and describes the best method to employ.

The pulp can be easily and economically softened by the action of steam without any pressure. If pressure is applied, an autoclave is necessary, but the length of the heating process is reduced ; very encouraging results have been obtained from laboratory experiments.

Super-heated steam and hot air soften the pulp very satisfactorily, provided some of the moisture of the fruits has been driven off ; the expense of concentrating the oil afterwards is decreased, but both super-heated steam and hot air require a costly plant.

When the palm-nuts are placed in chambers heated by the direct action of fire, the colour of the oil is darkened and its market value is affected.

Too expensive an installation is necessary for heating the bunches of nuts and thus reducing the trouble of separating the fruits from their stalks, but the ideal method would be to hang up the bunches in closed chambers artificially heated with steam under pressure or hot air. When they are quite dry a jerk would be sufficient to detach the nuts, while their stalks would remain attached to the upper part of the autoclave.

Pressure should be applied immediately after heating. As the amount of water in the fruits makes it impossible to apply great pressure at first, the nuts must be subjected to low pressure at the beginning and the pressure increased later, in order to exhaust the pulp completely. Recent experiments have shown that low pressure extraction of the oil begins at 2 ½ atmospheres, whereas the maximum oil flow is only obtained at pressures of 50 atmospheres ; half the remaining oil is extracted from the pulp with pressures ranging from 50 to 100 atmospheres. Any pressure exceeding 100 atmospheres extracts fibrous substances together with the oil.

In order to obtain a higher oil yield than has hitherto been produced, it would be necessary to use pressures up to 425 atmospheres, employing hydraulic pumps of the type made by ALLIOT and Co. Nottingham. The pulp present can be removed from the oil by a long decantation process. The crude product must never be allowed to get cold, as the pulp swimming on the surface would absorb many of the fat globules.

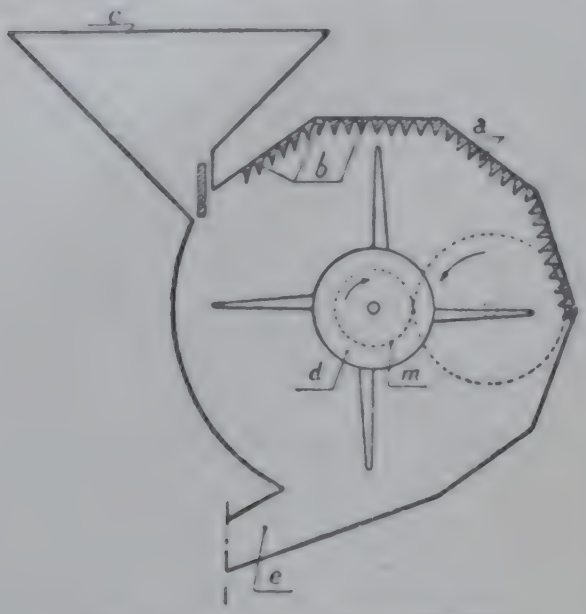

FIG. 112. — Palm kernel crusher.

II. — MM. SIGG and JACQUARD (Paris) have tested an industrial plant constructed for the purpose of extracing palm-oil by means of a solvent, which in this case was mineral oil. The pulp was washed six times and after the sixth washing, the oil was slightly coloured which perhaps warranted a seventh washing.

The oil is extracted by the vapour of the mineral oil which eliminated the moisture of the pulp. The experiments showed that whole fruits

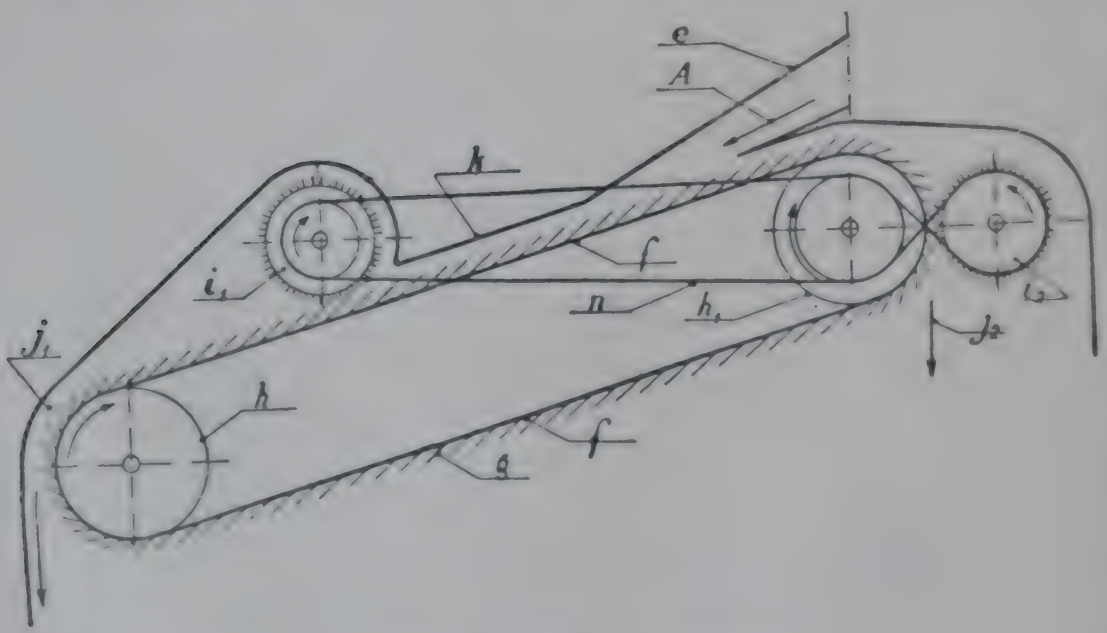

FIG. 113. — Palm kernel sorter.

are very little attacked by the solvent, while the kernels or "palmistes" are cooked. In this way the pulp alone can be treated. Any solvent

that does not attack iron may be used in this plant and the oil from the pulp of 1500 kg. of fruit can be extracted in 8 hours.

III. — The two processes in question were patented in France and the patent rights have been purchased by MESSRS LEVER BROTHERS LIMITED.

(a) *Preparation of palm-oil.* — The patented process consists in dividing or crushing simultaneously the fibre and pulp of the pericarp of fruits that have been boiled, and then removing the fibre and cellulose tissue in such a way as to leave the nuts.

Another process suggested for the treatment of the nuts of the oil-palm is to boil the nuts first, adding a small quantity of water and then subject the pericarps to crushing, preferably by means of the nuts themselves, until all their cells are broken and the fibres are disintegrated. This crushing can be carried out in a receptacle with a bottom, perforated or provided with slits, although other apparatus, for instance, a ball crusher with pads answers very well. The pulp thus obtained can be put into a closed centrifuge in order to separate the oil from the water.

A description is given also of an apparatus, consisting of a boiler with perforated bottom and bearing fixed and rotary shaking arms.

(b) *Process for separating the nut-kernels from their shells.* — This process consists in subjecting nuts, like those of the oil-palm, to a rapid rise of temperature in order to separate the kernel from the inner surface of the shell. This operation can be carried out by the action of steam in an autoclave. The nuts can be freed from their pericarp before treatment, or the whole fruit may be so treated that the pericarp is steamed during the process.

IV. — M. G. GALLOIS has invented a crusher-sorter for the kernels of palm nuts. The apparatus is composed of two parts that can be joined together, or used separately.

The crusher (fig. 112) consists of a nearly prismatic drum *a*, of which the inner surface is partially covered with diamond heads *b*. The nuts are put into the hopper *c* and pass (their discharge being regulated by a valve) into the drum where they are thrown against the diamond heads by a rotating projector *d*. The mixture of kernels and shells is evacuated at *e*.

The sorter (fig. 113) receives the broken shells and kernels which find their way in by *A*, fall upon an endless apron *f*, which is sharply inclined horizontally and moves in such a manner as to carry upwards the material it receives. The surface is studded with long, fine steel points (*g*) arranged obliquely. The kernels revolve upon this surface and find their way out at *j*, whereas the rough shells are caught and evacuated by *f* 2. The apparatus is furnished with two metal brushes *i* that sweep the kernels towards the exit *j* 1, detach the shells and clean the apron.

R. D.

[714]

715. **The Development of Acidity during the Retting of Flax: its Interpretation and Significance.**

EYRE, J. VARGAS and NODDER, C. R. (Linen Industry Research Association, Belfast). *Journal of the Textile Institute*, Vol. XV, N° 5, pp. T 257-T 272, figs. 24. Manchester, 1924.

The authors treat this interesting problem under the following heads: experimental retting tanks; methods of conducting a ret; estimation of acidity of retting water; graphical representation of results; description of graphs obtained in a typical ret; interpretation of graphs; application of the acidity curve method of control to experimental work; temperature influence; ripeness of straw; preliminary leaching; character of water; retting in flowing water; condition of straw; twice retting; determination of technical end-point in practice.

Problems in connection with the retting of flax are discussed with special reference to the character of the fibre-bundles and of the tissues in which they are embedded. The importance, both for scientific and industrial purposes, of having some means whereby corresponding stages in different rets may be recognised is pointed out. It is believed that a study of the development of acidity has afforded a satisfactory method for this purpose. By its use four stages in the retting process have been recognised; these are discussed and an interpretation of them has been put forward. It is further pointed out that the recognition of these four stages makes possible the accurate determination of the technical end-point, namely, the stage at which retting should be stopped in order to obtain the best results in the after processes.

The paper concludes with a discussion of the possible application of the method for the determination of the technical end-point in factory practice. A method is described of following the progress of retting by the use of a convenient apparatus which measures the electrical conductivity of the retting water. W. S. G.

716. **The Retting of Colonial Textile Plants by Means of *Bacillus felsineus*.**

I. BRUNO, F. Cultura e macerazione industriale microbiologica dell'*Agave sisalana*. *L'Agricoltura coloniale*, Year XVI, No. 4, pp. 121-131, figs. 4, separate from text, bibliography. Florence, 1923.

II. BRUNO, F. Studio sulla cultura ed industrializzazione della *Boehmeria nivea*. *Ibidem*, No. 9, pp. 321-332, bibliography, 1923.

CARBONE, D. La macerazione delle piante tessili coloniali col *Bacillus felsineus*. Ibidem, Year XVIII, N° 4, pp. 121-169, 6 tables separate from text, 1924.

I. — *Agave sisalana* is grown here and there throughout Southern Italy where it does exceedingly well, but up to the present no attempt has been made to use the plant for industrial purposes and it has therefore never been cultivated on a large scale. The fibre can be extracted mechanically when the plantations cover thousands of hectares, but this

process is not suitable where only a few hectares are under the crop, and it is impossible to contemplate setting up a cooperative establishment on account of the high cost of transport and also of the fact that only 4 to 5 % of the material can be turned to account.

Dr. BRUNO undertook to solve the problem of the possible industrial use of the plant under the conditions obtaining in Southern Italy. He found by experiment that retting with *Bacillus felsineus* is an easy, practical and economical process resulting in the production of a fine resistant fibre that is now much in request on the Italian market which obtains its supply from London.

In Sicily alone, there are 72 000 hectares of land that could be used for growing this crop. The author gives information regarding the methods of growing the plant and the yield to be expected. In the Colonial Garden of Palermo, it lives for 13 years before throwing up its flower-spike.

II. — *Böhmeria nivea* (" seta vegetale ", ramiè, " urtica bianca ", China grass), which supplies a very elastic, soft and glossy fibre, grows extremely well in Sicily, while in Somaliland it can be cut 5 or 6 times a year. The great drawback to extensive cultivation both in Italy and the Italian Colonies is the difficulty experienced in rapidly removing the hairs and cortex and degumming the stems.

The author examines the botanical characters of the plant, the method of cultivating it, and the process of extracting the fibre. He also records the observations he made in the course of his own experiments in the Colonial Garden at Palermo where he obtained 4 cuts in the year viz., in the middle of June, at the beginning of August, towards the end of September, and in the first half of December, the amount of stripped stems per hectare being respectively 147, 209, 153, and 112 quintals with a setting of 25 500 plants per hectare.

The crop could be used for industrial purposes if the retting were effected by *Bacillus felsineus*. By this process, which is described by the author, 3 to 3.15 % (calculated on the weight of the stalks) of fibre ready for spinning could easily be obtained. Böhmeria textile fabrics are made in Italy, but the fibre employed is imported. The author recommends its more extensive cultivation and according to the data which he supplies the undertaking could be made very profitable.

III. — In true retting, the cellulose and fibrous elements are separated from one another by the solution of the cementing substances whereas in pseudo-retting, the decomposition products remain and must be removed by washing accompanied by more or less energetic rubbing. The only agent of " true retting " that is so far known is *Bacillus felsineus*, an anaerobic micro-organism which was discovered by Dr. CARBONE in 1916. The agents of pseudo-retting are the aerobic pectic ferments. A pure preparation of *B. felsineus* which will last for years has been put on the market under the name of " felsinozima " by the Serotherapy Institute at 14 Via Lecchi, Milan. Its use enters into the simplest industrial operations. This method has been adopted for over a year at the factory of Messrs. M. BRUNELLI di PASCANO and Co. of Manorbio (Prov. of Brescia) where flax and also hemp are worked.

In the experimental department of the Microtherapic Institute, the author has used *B. felsineus* for retting various other plants, some of which are of special interest for Colonial agriculture. He describes the results he has obtained in the article under examination. He has tested: UNRETTABLE PLANTS: leaves of *Washingtonia filifera*, *Chamaerops humilis*, *Gynerium argenteum*; stems or branches of cotton. RETTABLE PLANTS, HEMP TYPE (whose outer tissue fibres can also be retted): *Sida* (*Abutilon*) *Avicennae* (fibre yield 13.5-22 % of the dry stems); *Asclepias Cornuti* (fibre yield about 15 % of the dry stems); *Sphaeralcea angustifolia*; *Grewia appositifolia* and *Gr. orientalis*. All are easily retted in 3 to 6 days.

RETTABLE PLANTS OF THE MULBERRY TYPE (the rettable fibrous portion is covered by unrettable layers, which must be broken through, or removed, before retting, and usually consist of a much chitinised epidermis. To this group belong many colonial plants. Ramiè, *Ricinus*, *Girardinia condensata*, *Neoglasiovia variegata* ("coroà" or "caroa") "tioù" or "tucum" (Brazilian palm) (1). *Gonphocarpus fruticosus* — *Agave sisalana*, *A. americana*, *A. candelabrum*, *A. yuccafolia*, *A. Sepuppi*, *A. Rumphii*, *Yucca gloriosa*, *F. altissima*, and *F. gigantea*, *Sansoviera cylindrica*, and *S. seylanica*. The author gives a detailed description of the results he obtained from these various species and concludes that many of the textile plants of hot countries can easily be retted by means of *Bacillus felsineus* (2). F. D.

717. Technological Observations on Agave Fibre from Indo-China.

ROEHRICH, O. Etude technologique d'une filasse d'agave d'Indo-Chine. *Bulletin de l'Agence Générale des Colonies*, Year 16, No. 181, pp. 1-7, 1 plate, Melun, 1923.

A detailed description of the special characteristics of agave fibre from Indo-China, the chemical reactions and the tensile strength as compared with sisal. Although a somewhat short staple, the twisting quality is exceptional and very suitable for carpets, etc. but rather inferior to sisal for twine manufacture. M. L. Y.

718. Preparation of Mimosa Bark for Sending to Europe.

PASSELÈGUE G. (Chef de travaux à la Station d'essais de Machines). Préparation des écorces de *Mimosa* pour l'expédition en Europe. *L'Agronomie Coloniale*, Year 10, No. 74, pp. 42-48, figs. 4. Paris, 1924.

In order to avoid the great difficulties involved in the importation from the Colonies of tanniferous barks, it has been suggested that the tannin should be extracted and sent instead of the bark. Unfortunately, the

(1) This is the *Bactris setosa*. See: ENRICO TEIXEIRA DA FONSECA, *Industrias das Madeiras e Plantas uteis do Brazil*, Rio do Janeiro, Officinas Graphicas Villas — Irmão and Co. 1922. (*Ed.*)

(2) See also: DE CARBONE. La macerazione industriale delle piante tessili col *Bacillus felsineus*. Stab. Tip. Stucchi, Cerutti and Co. Milan, 1922. (*Ed.*)

extraction of the tannin is such a delicate matter, that it has been found better to export the bark itself after it has undergone certain treatment for reducing its volume which consist in cutting, pounding and compressing. The author describes the various materials now used, their method of employment and the power required. R. D.

719. **New Method of Extracting Perfume from Plants.**

LINDET. Nouvelle méthode d'extraction des parfums des plantes. *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. X, No. 7, pp. 169-170. Paris, 1924.

M. ODDO has discovered from his experiments made at the factory of LAUTIER fils at Grasse, that about one-third more essential oil can be obtained without any loss in scent value by grinding rose or jasmine petals before digesting them with petroleum ether ; the effect is even more certain if the crushed flowers are pressed into a cake before being subjected to the action of the solvent.

This treatment has the advantage of liberating the essential oil in the form of a glucoside which comes into contact with the diastase. On the other hand, pressure after grinding reduces by 50 % the amount of matter to be treated with petroleum ether.

MM. LAUDIER and ODDO both state that by leaving jasmine flowers for some time in the presence of anhydrous sodium sulphate, or magnesium sulphate, the blossoms are dried without any change in their composition, and their yield of essential oil increases about 30 % if they are digested in contact with petroleum ether. If, however, in the extraction process the fat or oil is replaced by powdered charcoal, the scent of the flowers is absorbed, and the petroleum ether, when placed in contact with the charcoal, takes up 20 % more of the scent. R. D.

720. **The Turkish Tobacco Industry in Asia Minor and Macedonia.**

STELLA, L. M. *Journal of the Department of Agriculture, Union of South Africa*, Vol. VIII, No. 4, pp. 388-407, plates 5. Pretoria, 1924.

Results of an investigation made by the author in 1922. This includes an inspection of the tobacco warehouses, showing the method adopted for stacking and fermentation, cleaning, pressing, grading and classification, and also descriptive details as to the cultivation methods employed in Asia Minor and the systems of curing and marketing. A comparison is made with South African methods of producing Turkish tobacco, and the exceptional possibilities noted of extending this cultivation over a far wider area in that country provided that adequate arrangements are made for well equipped warehouses. M. L. Y.

721. **The Preservation of Fresh Fruit and Flowers.**

ZILERI, G. Alcuni appunti sulla conservazione della frutta fresca. *Rivista del Freddo*, Year IX, No. 1, pp. 18-23 ; No. 2, pp. 42-48. Roma, 1923.

The existence of cold storage for the preservation of fruit is closely connected with the presence of an Association of growers and fruit sellers

in the country, for it is only rarely that a single business of production or trade could bear the expense of the construction and upkeep of a cold storage depot as it is necessary to have a constant supply of products for storage. A cold storage depot for fruit can be used, during the off season, to preserve vegetables, eggs, milk, butter, flowers etc. so as to give a remunerative yield each month. The preservation of meat is a matter for urban cold storage and not rural especially because of the peculiar odours generated by animal products, which might impair the flavour of substances subsequently introduced into the refrigerators.

The preservation of fruit in cold storage is beneficial because it retards the process of ripening; sometimes, especially at too low temperatures, ripening is arrested, the products damaged and brown spots appear on the skin.

As different kinds of fruit behave very differently one from another no general rule can be given. It is therefore necessary to make separate observations for each type.

The duration of preservation increases in a variable manner as the temperature decreases. Generally the best temperature is about 0°C, but in certain cases a temperature below 0°C is recommended.

The relative humidity and the circulation of air should be regulated according to the kinds of fruit. For berries, for example, which easily become mildewed, the most suitable conditions are a rather low degree of humidity and not too strong a circulation of air, while for other fruit it is well to maintain a moist still atmosphere, so as to avoid premature withering or wrinkling. The temperature of the fruit is generally slightly higher than that of its environment. This difference gives an indication of the progress of the process of ripening and its increase indicates the moment at which the fruit ought to be taken out of cold storage and sold.

Generally while the fruit is in cold storage a decrease in the characteristic acids takes place: at first this makes the taste sweeter and more delicate, but later when the limit is passed the value of the fruit decreases.

Decrease in weight depends, for the most part, on the evaporation of moisture; for healthy and undamaged fruit this decrease is not considerable.

In the case of preservation of flowers by cold the problem is not so simple as for fruit. In fact the natural winter period of rest is replaced by an artificial period of rest, which may last for 8 or 9 months and enables any kind of flower to be procurable at any time of the year.

Generally young plants or seeds are placed in boxes, well filled with moss or mould, so as to avoid excessive drying, having first been watered; they are then kept at a temperature between -2°C and $+6$°C. The freezing point, which varies for each plant, must not be passed, even for a short time, otherwise the protoplasm dies.

The general minimum temperature -2°C given above is determined by the fact that the begonia, whose freezing point is the highest, freezes at -2°C, while the freezing point of ivy (the lowest) is -4°C, of the violet -9°C, of the tulip bulb -3°C, and that of the cherry laurel -5°C.

On the other hand temperatures above +6°C cause a process of fermentation which is dangerous for the plants.

For restarting growth care must be taken to accustom the plants to the conditions of temperature and light. They should consequently be kept shut up for 2 or 3 days at a temperature of about +15°C; the young plants should then be taken out of the boxes and left for several days in half-darkened cellars. By degrees the plants which are still blanched, will be accustomed to the sunlight and in a few days they will be completely revived. F. D.

722. Variety of Fruit relative to Cold Storage.

MACCIONI, M. Influenza del fattore "variata" sulla durata di conservazione della frutta in frigorifero. *Bollettino della R. Società Toscana di Orticoltura*, Year XLIX, Nos. 1-4, vol. IX (4th Series), pp. 3-9, tables, Florence, 1924.

Observations have been made at the "R. Scuola di Pomologia" at Florence (Italy) to demonstrate the conservation characteristics of different varieties of fruit in cold storage. It has been noted often that fruits such as pears, apples and plums, are affected in different ways according to variety.

The author reports the results obtained by the "Società Frutteto Cogo" and elsewhere with pears classified as summer ripening (July-September) and autumn ripening (October-December). For the first group the average period for cold storage was determined as 27-72 days. The "William" pears were the least resistant and the "Clapps Favourite" the most durable. For the second group, the average period for cold storage was 30-75 days, "Beurré Hardy" and "Duchesse d'Angoulême" standing first as the most durable and "Beurré d'Amanlis" the contrary.

Full details are given as to the period of conservation for some 19 varieties. M. L. Y.

723. The Industrial Uses of the Kaki Fruit.

I. CAUDA, A. Aceto di kaki, *Il Coltivatore*, Year 70, No. 12, pp. 375. Casale Monf. 1924.

II. MANZONI L. A proposito di aceto di kaki. *Ibidem*, No. 15, pp. 468-469.

I. The following method of preparing kaki vinegar has been recommended by Prof. CAUDA as giving excellent results. Quite ripe fruits are selected and reduced to pulp; the pulp is then boiled for about 30 minutes and left to cool down to 30°C, after which 1 % of ripe medlar pulp is added. The receptacle containing the mixture, which should be a vessel with a wide mouth and only half-filled, is left open in a warm place, preferably in the sun. In a fortnight, a large amount of acetic acid is produced and the vinegar thus made has a pleasant, aromatic taste. If a large quantity is required, the pulped kaki fruit is diluted with two-thirds of water and the liquid obtained is filtered off.

II. In 1921, Signor L. MANZONI, of the "R. Scuola di Viticoltura ed Enologia" of Conegliano, made excellent vinegar with a pleasant odour and taste and containing 89 % of acid from fermented kaki-fruit juice to which

some acid (tartaric or citric) or potassium bi-tartarate or wine-yeast had been added. Alcohol as good as that made from the distillation of sugar can be obtained from the juice of kaki-fruit. Further a delicious beverage with 9.6 % of alcohol can be made from the kaki-fruit adding a fourth part of grape must. It will keep for at least 3 years as has been proved by actual experience (1). F. D.

724. **Some Methods for Preserving Mangoes.**

ZAMUCO, C. T. and LOMBAO, P. *The Philippine Agriculturist*, Vol. XXII, No. 8, pp. 323-331, bibliography. Los Baños, (Laguna), 1924.

As the mango quickly decays, experiments have been made in the Philippines to find a satisfactory method of preservation, thus making the fruit available for export. Before packing and during the following six months the dried fruit was closely observed for appearance and flavour. Previous to canning and dehydrating, the mangoes were allowed to become yellow and fairly hard and then cleaned, classified as to size, degree of ripeness, and freedom from disease. After slicing, the sections were placed in a salt solution and then on to trays for sulphuring or drying, or into the preserved syrup for canning.

Comparison were made between sun drying, sulphuring and sun drying, artificial heat. The results indicate: (1) the great advantage of drying or evaporating mangoes, over any other means of preservation as regards reduction in bulk of the fresh fruit; (2) fruit at the proper stage of ripeness, when peeled, quartered and sulphured, for 30 minutes, dries more quickly than when not sulphured and evaporation takes place more rapidly in trays on a cement floor than on either bamboo or sod; (3) evaporation independently of weather conditions by using artificial heat at an average temperature of 67° C gives a better appearance and flavour than when sun dried; (4) canned mangoes with thin syrup retain their attractive natural colour, medium acid and sweet flavour and semi-melting consistency, to a greater degree than by any other method of preservation tried.

M. L. Y.

Animal Products.

725. **The Colour of Milk and its Food Value.**

DOAN, F. I. (Dairy Husbandry Department, Maryland Agricultural Experiment Station, College Park, Maryland). The Colour of Cow's Milk and its Value, *Journal of Dairy Science*, Vol. VII, No. 2, pp. 147-153, Table I. Baltimore, 1924.

Milk is an almost opaque liquid, composed of fat globules in a temporary emulsion, casein, colloidal albumen, sugar, albumen and salts in solution. It varies in colour, from yellowish-white to almost pure white, or even bluish-white. The colour of milk depends on various factors of which the most important is the yellow hue of the fat globules, but the size of

(1) See *R.* 1922, No. 492 (*Ed.*)

the globules influences the tint of the milk quite as much as their colour. In fact the surface of the small globules is larger in proportion to their size than the surface of the larger globules, and since the light is reflected in all directions from these surfaces, the reflexion may be greater and more diffused in the case of milk containing small globules, so that such milk may look whiter than milk with large globules although, other conditions being equal, the total fat percentage is the same.

The opaqueness and whiteness of milk are also affected by the number and size of the colloidal substances present, but it has been ascertained that the amount of fatty matter is the chief factor in determining the colour.

It may be said that the yellow colour of different milks will vary in proportion to the number of the fat globules present, even if these globules are all of the same shade. PALMER and ECKLES have shown that the pigment of milk fat is carotin associated with a small amount of xanthophyll, and that these pigments are identical with the pigments found in the green and the yellow parts of plants. They are absorbed with the animals' food and secreted in the butter-fat without having undergone any visible change. It is thus shewn that it is possible to alter the colour of the butter-fat in milk by varying the amount of pigmented foods in the ration, and the difference in the colour of spring milk as compared with that of autumn and winter milk is also thus explained. At the Maryland Station, two cows were fed a ration of forage-beet silage, beet pulps and concentrates ; their milk contained fat with a coloration coefficient of 5 ; on adding to the ration 9 kg. of green rye, the colour coefficient rose 30 units in 15 days.

It is well-known that colostrum is always of a very deep colour ; this is chiefly due to the intense coloration of the fat which is increased by the amount of lipochrome present at the time. In the case of 2 cows, the coloration coefficient of the colostrum was 43 units a day after the animals had calved and this figure fell to 5 units in the course of 6 to 16 days.

The depth of the colour of the colostrum does not depend solely upon the greater or less amount of pigmented food given, for it is probable that during the lactation period, there is an accumulation of yellow pigment in the body-fat which is broken up and secreted in the first milk after calving. The intense colour of colostrum may also be due, at any rate in part, to the absorption of the corpus luteum in which PALMER and ECKLES detected a large amount of carotin. In short, the pigmentation of milk is caused in the first place by the colour of the fat, that is to say, by the amount of lipochrome it contains, as well by the high percentage of fat in the milk. Naturally, other factors affect this coloration but only in a secondary degree. Amongst these factors may be mentioned the greenish-yellow colour of the milk serum caused by a pigment called lactochrome, which is the same as the urochrome found in urine. The effect exercised by the colour of the serum in the pigmentation of the milk is not well understood, but is none the less real.

The colour of milk is an important question commercially, for customers unanimously prefer yellowish milk, as they consider it to be the richest

in cream. The theory has also been put forward that carotin and the fat-soluble vitamine A are identical, or at least closely associated. This has however, been strongly opposed by PALMER and KENNEDY who maintain that a milk containing slightly-coloured butter fat is not necessarily deficient in vitamines, but under present trade conditions, it is true that the above theory proves correct in the majority of cases. In any event, the milk of a cow that has been fed a liberal ration of green forage contains highly pigmented fat and has a higher vitamine percentage than the milk of a cow given hay, silage, roots and concentrates.

The author describes the apparatus used in the colorimetric testing of milk-fat, as well as the method of preparing milk samples for this test. He afterwards summarises in a table the results of an experiment made for the purpose of testing the variations produced in the pigmentation of the butter-fat by changes in the cow's diet. From this table, the following conclusions may be drawn : the pigmentation of the fat varies approximately in relation to the amount of green food assimilated. It may be true enough that the colour of milk is not of supreme importance, and yet under present commercial conditions it is certainly a guide to the quality of the milk as regards its vitamine content, and probably gives an indication of the presence or absence of other vitamines that should be taken into account in determining the food value of the milk.

P. D.

726. Changes in the Specific Gravity of Milk during its Passage through various Machines.

RAHN, O. Veränderungen des spezifischen Gewichts der Milch durch Molkereimaschinen. *Molkerei-zeitung*, Year 38, No. 38, pp. 779-780. Hildesheim, 1924.

In 1913, FLEISCHMANN and WIEGER (*Journal für Landwirtschaft*, Vol. 61, p. 283) showed that milk which has been heated a short time previously has a lower specific gravity than the same milk when it has been left longer to cool after heating. This difference is due to the fact that the fat as it gradually solidifies acquires a greater specific gravity.

These observations may be supplemented by some data concerning the alterations taking place in milk during its passage through the different machines (regenerator, pasteuriser, centrifugal cleansing apparatus and refrigerator), in the course of the tests carried out at the Physical Institute of the " Preussische Versuchs und Forschungsanstalt " at Kiel of which the author is Director.

The results of these trials fully confirmed the observations made in industrial practical dairy work. Shortly after the milk has passed through one or more of these machines, the specific gravity of the milk is reduced by some thousandth parts. The fall in specific gravity induced by the centrifugal apparatus is due to the air incorporated in the liquid and hence it is greater the more rapidly the machine revolves.

F. D.

727. **The Destructive Action of Unboiled Milk upon Bacterial Ferments kept in Sterilised Milk: The Empirical Selection of Lactic Ferments.**

MAZÉ, P. De l'influence du pouvoir bactéricide du lait cru sur les ferments lactiques entretenus dans du lait stérilisé et de la sélection empirique des ferments lactiques. *Comptes rendus de l'Académie des sciences*, Vol. 178, No. 17, pp. 1434-1436, Paris, 1924.

It is probable that the bacterio-destructive power of fresh milk which depends on the alexins taken up from the blood varies in the different breeds of dairy cattle. It is especially strong at the beginning of spring, owing to the effect of the change in diet. The fact that lactic ferments kept in sterilised milk lose their "immunity" in relation to fresh milk must be taken into consideration, if it is wished regularly to prepare active lactic ferments.

The acquired or natural immunity of resistant species is maintained by a treatment which has been adopted as a result of practical experience. Such immunity is turned to account by the Breton farmers' wives in the preparation of viscous milk ("gros lait"), or "gweden". The milk is inoculated immediately after being drawn from the cows, i. e., at a temperature of 35°-38°C, with about 2% of fermented milk taken from a previous preparation. The milk curdles in 10-12 hours in summer, and at the same time assumes a gelatinous consistency which persists, even when the milk is vigorously churned. The lactic ferment of "gweden" occurs in the form of long chains of spores enclosed in a thick mucilaginous sheath. When cultivated in sterilised milk at 150°C, this ferment more or less quickly loses its property of making milk viscous; but rapidly regains this power after passing several times through unboiled milk, or serum from cattle, provided neither substance contains the bacterio-destructive principle.

F. D.

728. **A New Practical Method for Estimating the Cream removed from a Sample of Milk.**

CARRIEU and CASTAGNÉ. Nouveau procédé pratique pour apprécier l'écrémage d'un échantillon de lait. *Le Lait*, Year 3, Part IV, No. 33, pp. 188-192. figs. 2. Lyons, 1924.

The authors have adopted, as a basis for their work, Dr. SEPTELICI's process for detecting the addition of water to milk and have applied it to the estimation of the extent to which the cream has been removed. The principle of the method is as follows: If two organic liquids, one of which is coloured, are brought into contact, different coloured images are produced which are called "morphological phenomena." The authors have studied the technique of the method and the importance of the evidence it affords as to whether or not the milk has been watered. Twenty-five drops of fresh, pure serum are mixed with one drop of Chinese ink. A series of large drops of the milk to be investigated is allowed to fall upon a sheet of glass, and one drop of the liquid indicator is placed

in the centre of each. When the milk is skimmed, but not watered, the indicator floats, and clear spaces that disappear are formed in the drop giving it a stellar appearance; then rectilinear radiations are formed which cover all the drop and make it appear iridescent.

If the milk has been skimmed and adulterated by the addition of $^1/_4$ of water, or if it has not been skimmed, and whether or not watered, the indicator sinks into the drop. Boiling does not affect the results.

The phenomenon is positive in the case of skimmed milk to which no water, or at most only 1/8 of water has been added. If a negative result is obtained from any given sample, the sample is skimmed and the work begun again. Under these conditions, a positive result shows the milk to be pure or almost pure, whereas a negative result proves that 25 % or more water has been added. The chief defect of this method is its inability to reveal the presence of less than 20 % of water and it is thus insufficiently delicate for present requirements. The authors have successfully employed numerous serums and results have been quickly given in every case. The fact that the reaction is always distinctly positive in pure skimmed milk suggested to them a further means of using this method, viz., in the determination of the removal by skimming of 25 % or more of the cream. Milk that has been entirely freed of its cream by centrifuging is used in the various dilutions of pure whole milk, the amount added being determined by Gerber's process. Milk from which 100, 75, 50 qnd 25 % of the cream has respectively been removed always gives a positive result. A lower degree of skimming gives results that are less clear, indeterminate, or even doubtful. With the exception of rare cases where it is visible to the eye that milk has been skimmed and watered to a large extent, the method is of real practical use for detecting the skimming of a sample of milk. It is of great use when adopted in the case of milk proved by previous testing not to have been watered. The results obtained are then extremely conclusive as regards the detection of skimming involving the removal of 25 % or more of the cream. A positive reaction shows the milk to have been deprived of most of its cream; a negative reaction proves that the milk is whole, or has been skimmed to an imperceptible extent, a doubtful reaction testifies to the removal of a little of the cream.

P. D.

729. The Effect of Dairy Operations upon the Cream on the Surface of Milk.

MARTIN, W. H. and COMBS, W. B. (Dairy Husbandry Department, State College, Pennsylvania). The Effect of Milk Plant Operations on the Amount of Cream Rising on Milk. *Journal of Dairy Science*, Vol. VII, No. 2 pp. 197–204, tables 5, graph 1, plate 1. Baltimore, 1924.

The consumer often judges of the richness of milk from the amount of cream that rises to the surface of the bottle, but unfortunately this al-

fords no evidence of the fat content of the milk, for the layer of cream is often reduced in thickness by the transport of the milk to the dairy and the operations to which the milk is subjected. A study of the effect of these various operations upon the cream rising to the surface of milk has been made at the Pennsylvania State College Creamery. The factors studied were; clarifying, pumping cold and hot milk, shaking hot milk, various methods of heating and cooling pasteurised milk.

The capacity of milk for producing cream was estimated by taking samples of milk before and after each operation; these samples were placed in graduated cylinders, so that the cream percentage could be read off at once. The cylinders were kept at the temperature of melting ice and readings were taken every hour during the 24 hours.

Milk at 55° F and 90° F on being treated in the De Laval centrifugal clarifier showed little tendency to cream production. No decrease was noted if the milk was heated to 90° F after clarification.

Pumping cold milk does not cause it to lose its creaming power and the diminution is very slight if the milk is pumped when it is hot.

With a view to determining the effect of pasteurisation and cooling upon the creaming of milk, the following experiments were made. After pasteurisation, some of the milk was left in the basin to cool while the remainder was rapidly cooled by passing over a surface refrigerator immediately after it had been heated. Various types of pasteurisers were also tested. It was discovered that, as compared with the volume of cream rising to the surface of raw milk, there was a loss of 30-35 % and 60 % in milk that had been pasteurised and cooled in a receptacle with glass walls; the loss was reduced to 7.8 % and 15 % if the cooling had been effected by means of a surface refrigerator and immediately after the heating. The loss was 8.17 % and 15 % in the case of milk pasteurised and cooled in a pasteuriser with serpentine cooler, but the loss in the same milk cooled on the refrigerator fell to 3 % or 7 %. A similar experiment once registered a gain of 8 %. It must therefore be concluded that milk cooled in a pasteuriser loses much of its creaming capacity, but the extent of the loss depends on the type of pasteuriser used and the amount the milk is shaken. Hot milk when shaken gradually loses its power of creaming; the loss is slight during the first two hours, but subsequently rises to 25-65 %. The only means of preventing this loss of creaming is to cool the milk as rapidly as possible and with the minimum amount of shaking. The partial failure of milk to cream is generally attributed to a mechanical cause, a kind of division by shock of the fat globules. The following experiment was conducted with the object of testing this theory. Some whole milk was skimmed, and both the cream and the skim milk were shaken for several hours. Then the cream and the milk were mixed together. It was found that the shaking had little effect on the cream but the layer of cream that rose to the surface of the reconstituted milk was much thinner than it would have been normally. The chief cause of the variation in the amount of cream rising to the surface of milk is an alteration in the whey, but not in the butter-fat of milk.

P. D.

730. **Bacterial Flora in Ripening "Grana" Cheese.**

DALLA TORRE, G. Contenuto microbico nella maturazione del formaggio grana. *Annali dell'Istituto sperimentale di Caseificio in Lodi*, Vol II, Nos. 5-6, pp. 174-176. Lodi, 1924.

The normal bacterial flora of "Grana" cheese has been found by the author to differ but little from that of other cheeses made from boiled curd *pasta cotta*. The greater number of the bacteria and those which remain longest in the cheese are the types producing the lactic ferments, and especially certain short rodlike forms some of which have no coagulating power, whereas others coagulate the milk more or less quickly, with or without the evolution of gas; with these bacilli are associated various cocci; these have a favourable action on the cheese and hasten its ripening.

F. D.

731. **Emmenthal Cheese in Boxes.**

BUTENSCHÖN, H. Schachtel-Emmenthaler ohne Rinde. *Molkerei-Zeitung*, Year 38, No. 29, pp. 560-561. Hildesheim, 1924.

Since about 1912, the firm of Gerber and Co. of Thun (Switzerland) have been putting on the market a special type of soft cheese made in cubes covered with tin-foil and packed in shallow, round boxes (diameter 10-11 cm.; height 2.5 cm. weight 125 or 250 gm.) which at once became widely popular. This is a very fine cheese with a consistency midway between that of a hard and a soft cheese respectively. It is now made by other Swiss firms and also in Germany and Austria under the names of "Schachtel Emmenthaler ohne Rinde" (Rindless Emmenthal cheese in boxes), "Schactelkäse" (boxed cheese), "Portionenkäse" (cheese cubes). This kind of cheese aroused much interest in the United States. Very inaccurate and discrepant accounts have been circulated as to the manner of its manufacture which are corrected by the author.

The ordinary apparatus that serves for making cheeses of boiled curd cannot be employed in the manufacture of cheese for packing in boxes and it is necessary to have a special machine of the type produced by a Swiss firm and recently also manufactured by a German house.

The cheese is prepared in the following manner: Emmenthal, or some other cheese, is taken when hard and perfectly ripe, and finely grated by means of a special machine, after which it is worked in vessels that can be heated and in which the pressure is reduced. The mass is at first leathery and thread-like, but it soon assumes the consistency of cream, so that it is easily poured into little receptacles of tin-foil that have been made in the required shape and size by means of a machine. The full receptacles each contain about 45 gm. of cheese and are hermetically sealed by machinery, left for some time in a cool place and then packed in cardboard boxes.

F. D.

732. **The Bulgarian Cheese, " Kaschkawal ".**

HEIDUSCHKA, A. (Landesstelle fur " offentliche " Gesundheitspflege, Dresden). Uber dem bulgarischen Käse, " Kaschkawal ". Zeitschrift für Untersuchung der Nahrungs und Genussmittel, Vol. 47, Part 4, pp. 260-261 Münster, 1924.

From the data furnished by As. ZLATAROFF (*Jahrbücher der Universität, Sofia*, Vol. 19, No. 3, 1922-1923) it is seen that a large amount of Bul garian " Kaschkawal " cheese still continues to be exported.

Before the War, the annual production of this cheese was 5 to 6 thousand tons of which some two thousand were exported.

" Kaschkaval " is made almost exclusively from ewes' milk, rarely from the milk of goats and never from that of buffaloes. The essential point in its manufacture is the almost complete removal of the whey which is eliminated by pressure. The curd is then allowed to ferment for two days at longest and worked in water at 50°-60° C until it becomes of a gummy consistency, after which it is made up into balls that are kept for 3 to 5 hours in metals moulds. The forms are then salted and placed in rows one above another. For 2 or 3 weeks, the cheese are salted and arranged in layers every day, after which they are either put on the market as fresh cheese, or are placed to ripen in well ventilated rooms where they remain one month, or sometimes even less.

" Kaschkawal " is made in the high mountain districts of the Balkans and the Rhodope chain.

The authors analysed a sample of a light yellow colour and containing but few eyes (0.5 per 1. cm.) ; it had a peculiar and pleasant flavour. They obtained the following percentages : water 29.69 — fat 29.11 — nitrogenous substances 28.74 — ash 8.96 ; — fat refraction at 40° C, 41.5°. The average of 17 analyses made by ZLATAROFF gives : water 29.52 — fat 28.99 — nitrogenous substances 31.33 — ash 6.78 %. From this cheese, the author has isolated two yeasts and *Micrococcus lactis acidi.*

F. D.

733. **Contribution to the Composition of Rennet.**

SAVINI, E. Primo contributo alla composizione dei cagli. *Annali dell'Istituto sperimentale di caseificio in Lodi*, Vol. II, Nos. 5-6, pp. 137-143, Lodi, 1924.

The analysis of a rennet in the form of a paste made of salted, compressed pieces of the abomasum of calves used in making " caciocavallo " to which it gives, after a short ripening process, a special flavour and smell. 100 parts of the substance in its natural condition were found to contain : water 27.048 — nitrogenous matter 20.125 — ether extract 28.820 — soluble extract 35.709 — total ash 12.714 — sodium chloride 9.026 — organic matter 60.238 — insoluble organic matter 35.448 — N-free-ganic matter 40.113 — acidity calculated as normal capronic acid 6.880 — ratio 1 to 6000 parts of milk. The analysis of the soluble extract is also given.

F. D.

734. **Gas-Producing Bacteria in Milk Used for Cheese Manufacture.**

DALLA TORRE G. I batteri gassogeni nel caseificio. *Annali dell'Istituto sperimentale di caseificio in Lodi*, Vol. II, Nos. 5-6, pp. 144-157, Lodi, 1924.

An examination of the injurious action of gas-producing bacteria in milk destined for the cheese factory. The author also considers the best means of lessening and preventing this bacterial activity, and lays stress on the importance of discovering new preventive methods, as those now adopted are wholly inadequate. F. D.

735. **A Practical Guide for the Economic Production of Milk.**

Cartilla practica sobre la producción económica de la leche. *Boletín No.* 45, *Ministerio de Industrias, Inspección nacional de Ganadería y Agricultura, República Oriental del Uruguay*, 1924.

This pamphlet treats of the following points:— (1) The commercial factors (qualities of milk for consumption; regularity of production); (2) transitory factors (period of lactation, age, conditions of health of the cow). The importance of each factor is considered and the practical means of influencing it are indicated. A series of practical examples of solutions of general problems is given at the end.

The pamphlet is evidently written for purposes which are exclusively didactic and propagandist. F. D.

736. **The Wools of Cirenaica.**

MANCINI A. Le lane della Cirenaica. *L'Agricoltura coloniale*, Year XVIII, No. 4, pp. 129-135. Florence, 1924.

There are several different commercial types of Cyrenaic wool, but they all come from Barbary sheep bred in the country. The wools of Barga-el-Beida (the pre-desert region) are more or less whitish, those of Barga-el-Mamra (the Mediterranean region with red soil) are reddish or red. All the wools are very soiled and dirty and also somewhat coarse, but they are valuable and are used for stuffing mattresses, making coarse fabrics, excellent blankets etc. The locks of the wool are long and conical, and hence the fleeces are more valuable than the short-wooled fleeces formerly obtained from the sheep sent to Egypt to be fattened for the butcher. The average weight of the fleeces is 2 kg., and the annual wool production is estimated at 4000-4500 quintals. The chief centres of the wool trade are Bengasi and Derna. The Government has recently issued regulations for the suppression of fraud in the wool trade. F. D.

737. **New Method of Distinguishing between Natural and Artificial Honey.**

AUERBACH, F. and BODLANDER, E. (Chemisches Laboratorium des Reichsgesundheitsamtes, Berlin). Über ein neues Verfahren zur Unterscheidung von Honig und Kunsthonig. *Zeitschrift für Untersuchung der Nahrungs- und Genussmittel*, Vol. 47, Part 4, pp. 233-238. Berlin, 1924.

The method proposed by the authors for distinguishing natural from artificial honey is based upon the estimate of the proportion of fructose

to glucose. In natural honey, the amount of fructose is from 106 to 119 % of the glucose, whereas in artificial honey, it is generally less than 90 %, and even much lower, when the honey is prepared by the addition of starch syrup, or starch sugar.

Fructose is the name given to the excess content in reducing sugar as regards the glucose content and is estimated by means of a special process devised by the authors. F. D.

738. **The Suffocation of Silk-Worm Cocoons by Chloro-Picrin.**

BERTRAND, G. Soffocamento dei bozzoli con cloropicrina. *Comptes Rendus de l'Académie des Sciences*, Vol. 178, No. 21, pp. 1656-1660. Paris, 1924.

The author described his studies and experiments which show that silk-worm cocoons can be completely and quickly suffocated by the use of chloropicrin. One gm. in volatile form per kg. of cocoons at ordinary temperature suffices to suffocate the cocoons throughly in 1 hour. Cocoons thus treated lose all smell of chloropicrin almost at once if they are exposed on screens to the air. They also dry very easily.

Suffocation by means of chloropicrin has no effect upon the outer silk. After treatment, the cocoons do not differ in qualities or colour from untreated cocoons. They reel, for instance, with the same facility, while their yield of raw silk is equal or superior to that of the cocoons suffocated by industrial methods such as dry and damp heat.

The physical properties and silk yield after degumming are the same in the case of the raw silk obtained from the cocoons suffocated by chloropicrin and by the ordinary processes.

The cost of chloropicrin treatment is lower than that of the methods now generally employed. F. D.

PLANT DISEASES

Diseases non-parasitic or of unknown origin.

739. **Frost as a Cause of Unsoundness in Sal Timber.**

HOPKINS, G. M. (Indian Forest Service). *The Indian Forester*, Vol. I, No. 5, pp. 243-246. Allahabad, 1924 (1).

Attention is drawn to the unsoundness in *sal* timber caused by the severe frosts of 1904-05. In the Ramnager division (United Provinces) the author has found forest areas damaged to the extent of about 3000 acres, practically every *sal* being more or less unsound. Of 44 trees felled, 34 were affected by rot.

(1) See *R.* 1924, No. 109. (*Ed.*)

Conclusions :— 1) Rot as the direct result of the frost damage has seriously affected almost all sal trees in these areas.

2) The rot progresses down from the point of frost damage towards the base of the tree at the average rate of 7 inches per year.

3) As the damage increases yearly it is evident that when these stands are mature they will be useless for the production of valuable timber.

4) Such badly damaged trees should be removed at once. W. S. G.

740. **Tar, Smoke, and Coal Gas as Factors Inimical to Vegetation.**

PRIESTLEY, H. J. (Professor of Botany, University of Leeds). *Science Progress*, Vol. XVIII, No. 72, pp. 587-596, bibliography. London, 1924.

The author has studied the various problems grouped under the above title and considers that the subject may prove of practical interest to the horticulturist and the public authority who is trying to provide avenues of shade trees in populous thoroughfares.

The problems are discussed under the following headings :— Tar, illuminating gas, the toxic action of traces of illuminating gas, smoke, the reasons for the toxicity of unsaturated hydrocarbons, gas poisoning and horticultural practice. W. S. G.

Plant Parasites.

741. **Uredinæ of the Iberian Peninsula : the genus *Puccinia*.**

GONZÁLES FRAGOSO, R. *Uredales* (Royas de los vegetales). Tomo I : Género *Puccinia*. In Junta para ampliación de estudios e investigaciones científicas. Instituto Nacional de Ciencias. Flora Ibérica, 1 vol. in 16° of pp. LXXI-410, with XIV-208 figs. Madrid 1924.

This volume, published with a preface by Prof. Ed. FISCHER of Berne is entirely devoted to species of the genus *Puccinia* hitherto reported or likely to be found in the Iberian Peninsula.

A detailed description of the Uredinæ is given, a general bibliography of these typically parasitic fungi and also one more directly relating to the Peninsula are provided. The author deals with each species of *Puccinia*, grouping them acording to the families to author the respective host plants, which bear them in teleutosporic form, belong, this part being followed by the enumeration of the genera of these matrices in alphabetical order.

For each species the author gives the special bibliography, possible synonymy, description, *habitat*, with indications also of the common Spanish name or names of the plant attacked and the geographical distribution. There follow : (1) an index of the scientific names given to the Uredinæ described or mentioned in the present volume, and of their respective synonyms ; (2) an index of the scientific names of the host plants or matrices of the Uredinæ included in the volume under reference ; (3) an index of the better known common names of the plants attacked by the Uredinæ mentioned. G. T.

742. **Tests of Resistance of Winter Wheats to " Caries ".**

ZADE. Die Anfälligkeit unserer Winterweizensort gegen über dem Steinbrand. *Mitteilungen der Deutschen Landwirtschafts-Gesellschaft*, Year XXXVIII, No. 52, pp. 666-667. Berlin, 1923.

The experiments were carried out at the Agricultural Institute of Leipsic in the years 1920-1923, with 56 types of wheat which being infected with caries or smeared with caries spores, were sown in a triple series of plots each of 1 metre square ; when ripe, the proportion of affected plants in each plot was determined, indicating the percentage of those that were immune. Close agreement between plots occupied by each of the different types and uniform results for any particular type in different years were not obtainable. No plot contained either only healthy or only affected plants. On the whole the maximum resistance was shown by the " Heils Dickkopf ", which can be considered as practically immune ; after it came : " Pommersche Saatgutgesellschaft Stamm 53 " (family 53 of the Society for the Production of Selected Seeds, of Pomerania) ; " Crievener 104 "; " Kirsches Dickkopfweisen " (the " Heils Dickkopf " subjected to various special tests and sown at different times), which proved always equally resistant. The selection in each plot of ears of immune plants for sowing, repeated for many generations in the attempts to produce more resistant races, has so far given negative results. F. D.

743. **Means Adopted in Poland for Protection against Contagion by Black Scab of Potatoes *(Synchytrium endobioticum)*.**

Communicated by Dr. L. GARBOWSKI, Chief of the Plant Disease Section of the State Agricultural Institute at Bydgoszcz and forwarded by M. B. MIKULSKI, Delegate of Poland on the Permanent Committee of the International Institute of Agriculture.

Potato-growing, which is one of the most important industries in Poland (in 1922, the potatoes harvested in Poland were 23.81 % of the world's potato crop) needs special care in order to keep the fields in a perfectly healthy condition. This vigilance is the more necessary, since the tubers are not only exported to the neighbouring States, Czecho-Slovakia, Lettonia, but also to more distant countries, France, Italy and Denmark.

In these circumstances it is of paramount importance to be able to give detailed information as to the means to be employed to protect the fields in Poland from the invasion or contagion of black scab (*Synchytrium endobioticum*), which is so serious a scourge of the potato crop.

As long ago as 1917, black scab made its appearance in the voievodat of Pognán, on an estate in the district of Chodziez, near the German frontier. Another outbreak of the disease had been reported from the district of Pazozyna, in Silesia. In both cases, only an isolated field was attacked, so that the whole crop could well be destroyed and the infected ground was placed under special supervision to prevent the spread of the disease. The measures taken proved entirely effective, for the disease has never occurred again in the same places, or in their vicinity.

After the Section of Plant Diseases had been created at the State Agricultural Station of Bygoszcz in 1921, a systematic enquiry was organised with a view to ascertaining the exact condition of the potato crops and discovering where black scab had made its appearance in the country. As a result, a new case of the disease was discovered in the district of Leszno (voievodat of Poznén), while the potatoes were being lifted, on a small field of ½ hectare. All the crop over more than 100 hectares of the same estate were carefully examined, as well as the potatoes on the neighbouring farms, but no further signs of infection were discovered. It was impossible to ascertain the origin of the disease, but it was clear that the outbreak was an isolated occurrence and since fortunately it was discovered at once, the parasite had not had time to spread to the adjoining fields. The infected tubers were made into "saidon" and the field was placed under supervision.

Another case occurred in Silesia in the district of Ruda in a small field of 18 ares; the potatoes were destroyed without careful inspection. Probably this was another sporadic outbreak, but the field was placed under supervision although it was possible that the case had only been a serious attack of ordinary scab (*Actinomyces* spp.) which is often mistaken for true black scab.

The most important point in the control of black scab is the defection of the small centres of infection before the disease has extended to the surrounding fields. So far this has been successfully accomplished and it can truly be said that under the conditions of rigorous inspection in which the smallest infected plot is kept, there is no fear of the malady escaping detection.

The best proof of the efficacy of the measures that have been adopted is the fact that, since 1923 no single case of black scab has been reported, even in the immediate neighbourhood of the centres of infection discovered in 1922.

The Ministry of Agriculture and State Domains has undertaken the inspection of all the potato crops grown in the voievodats of Posen, Pomerania and Silesia that are threatened with an invasion of black scab from the west. The bodies exercising this inspection are: (1) the Section of Plant Diseases of the State Agricultural Station at Bugdoszcz; (2) the Chambers of Agriculture of the above-mentioned voievodats at Posen, Torún and Katowice; (*c*) the 29 Schools of Agriculture in the same voievodats; (*d*) the local police authorities.

Each owner of potato fields is required to notify the local Authorities of any suspected cases of disease and these Authorities must at once report the matter to the Section of Plant Diseases at Bydgoszcz. Whenever the disease is found to be present, the potato refuse on the infected field must be carefully collected and burnt, while the diseased or suspected tubers must be consumed in the most summary manner; for instance, they may be transported under a guard of police to the nearest starch factory or distilleries, but they may not under any circumstances be used for seed, or fed raw as a stock-feed, though after boiling they may be given to animals.

When once black scab has made its appearance in a field, it is expressly forbidden that it should be planted with potatoes or root crops such as beets, carrots, etc.

The Polish Government has forbidden the importation of potatoes from Germany and Czecho-Slovakia.

The Section of Plant Diseases at Bydgoszcz has also on its own account instituted a permanent enquiry respecting the diseases and insects, which are injurious to the cultivated plants that have been put under its protection in the Provinces. For this purpose it has appointed special correspondents in the three voievodats of the west of Poland. In order to supply farmers with information concerning wart disease and the injury it might cause to the country if it were to remain unobserved or neglected, thousands of illustrated leaflets have been distributed containing a brief description of the disease and of the means of treating infected fields. These leaflets are sent out every year as a constant reminder to the public of the serious danger which threatens the entire country.

Attention is now being given to the organization of a special investigation of potato crops throughout the western frontier. This will be carried out with the help of inspectors who will visit the fields during the growth period and also at harvest time in order that there may be fuller information than at present as to the condition of the crops and that it should be easy, should danger arise, to have the potato fields examined as quickly as possible.

It is however, not only in the western provinces that provision is made of the means for arresting the invasion of the diseases of the various crops cultivated in Poland and especially the entrance of the black scab of the potato; the whole country already possesses a Phytopathological Service and hence there is little reason to apprehend that any serious or widespread disease of any kind could attack the crop without being speedily detected.

The centres of this Service are as follows:

(1) The State Agricultural Institute at Pulawy in the voievodat of Lublin where there is a Section for Plant Diseases similar to the section at Bydgoszcz;

(2) The Phytopathological Institute of the Higher School of Agriculture at Skierniewice (voievodat of Warsaw);

(3) The Plant Protection Station of the Horticultural Society at Warsaw;

(4) The Plant Protection Station attached to the College of Agriculture of the Polytechnic School at Dublany near Léopol;

(5) The Agronomic Experiment Station at Bieniakonie, near Wilno.

Each of these centres is connected with the Stations and their experiment fields, as well as with the agricultural Societies and agricultural schools of the voievodats and the corresponding districts. In this way all the crops throughout the country are kept under constant and organised supervision as regards the attacks of disease or injurious insects.

The Institutes and Central Stations are entrusted with the control of all potatoes intended for export and with issuing certificates testifying to the healthy condition of the tubers.

Polish legislation includes a special law regarding the destruction of the woolly aphis (*Schizoneura lanigera* Hausm.) and passed by the Diet on August 2nd 1919.

In conclusion, Poland may well claim the right of being regarded as well protected from attack by plant diseases and injurious insects. The best proof of the truth of this statement is to be found in the excellent and healthy condition of the potato crops which amounted to 337 500 000 quintals in 1922, viz. 138 % of the average pre-war yield obtained from the same acreage.

744. **Micromycetes observed on *Eucalyptus* spp., in Italy.**

TURCOMI M. Una moria di giovani piante di Eucalypti. *Atti del R. Istituto botanico dell'Università di Pavia*, Ser. III, Vol. I, pp. 125-135, 1 Tab. Milan. 1924.

At the beginning of November 1923 some fifty *Eucalyptus* plants (*E. amygdalina*, *E. citriodora*, *E. ficifolia*, *E. gigantea*, *E. Globulus*, *E. goniocalyx*, *E. melliodora*, *E. Muelleriana*, *E. resiniflora*, *E. robusta*, *E. Sieberiana*, *E. Sideroxylon*), belonging to the Royal Botanical Gardens of Pavia were placed in a damp airless situation in a greenhouse kept at a temperature of about 15°C. during the winter.

In the latter half of the same month grey or yellowish white warty pustules, in varying numbers and isolated or grouped, began to appear on the apical portion of the stems and on the upper branches of various plants, and were known as "swellings". Meanwhile the apices of the young stems and of the upper branches shrivelled up, assuming a blackish brown colour which extended afterwards gradually towards the base. The young leaves also shrivelled up and finally fell off. The damaged, defoliated and blackened branches dried up assuming a lighter colour until they became whitish. In some cases the lower branches were attacked and the old leaves on which spots formed along the nervation, brown at first and finally blackish.

The presence of a mycelium was noticed in the blackened branches, in the bark as well as in the wood and in the medulla.

In the dying, dead and dry portions of the young stems and branches as well as in the leaf spots, a conidial form developed, by its characters referable to the genus *Gloeosporium*. Mixed with the cluster of *Gloeosporium*, both on the leaves and on the branches and stems the pycnids of a *Macrophoma* appeared at the end of January 1924 and during the following February. Finally during the last ten days of March 1924 some perithecia referable to the genus *Physalospora* were found on a dry branch together with clusters of *Gloeosporium*.

Pending the establishment of the probable genetic connection existing between these three forms the author describes them provisionally under the names *Physalospora Eucalyptorum* n. sp., *Macrophoma Eucalyptorum* n. sp. and *Gloeosporium Eucalyptorum* n. sp. Most of the *Eucalyptus* plants attacked by the *Gloeosporium* are dead and the few survivors are in a serious condition. G. T.

Parasitic Plants.

745. **Note on the Presence of *Loranthus longiflorus* on *Eucalyptus rostrata* in India.**

PATVARDHAN, G. B. *The Journal of the Indian Botanical Society*, Vol. IV, No. 2, pp. 71-72. 1 table. Mount Road, Madras, 1924.

Several authors have stated that the Eucalyptus in India, is free from attack by *Loranthus longiflorus*, and the author reports that he personally observed the presence of Loranthus on *Eucalyptus rostrata* many years ago and also recently at Poona and elsewhere, and DESHMUKH later has noted the same in various localities.

It is consequently an ascertained fact that, like other trees, not even the eucalyptus is safe from the parasite, which settles on affected trees while the bark is still rich in sap and before it is old enough to peel off, unless the bark is resistant in the zone of attack. G. T.

Animal parasites.

746. **New *Coccidae* from various Countries.**

GREEN, E. E. and LANG, F. Description of some apparently new Non-Diaspidine *Coccidae*. *Bulletin of Entomological Research*, Vol. XIV, part 4, pp. 415-419, 6 figs. London, 1924.

The writers publish descriptions of six new *Coccidae* collected in different parts of the globe. The following are worthy of special mention:—

(1) *Stictococcus anonae* n. sp. found at Amani (District of Tanganika, Equatorial Africa), on the fruit of *Anona muricata* which appeared incrusted with the coccid.

(2) *Pseudococcus vitiensis* n. sp., at Cuva (Fiji islands) on the leaves of the coco-nut palm.

(3) *Phenacoccus grenadensis* n. sp. in the island of Grenada (Little Antilles), on egg-plants and on the stems and leaves of *Aster* sp.

(4) *Lecanium* (*Akermes*) *colae* n. sp. at Aburi(Gold Coast), on *Cola acuminata*. G. T.

747. **Insects of the Island of Porto Rico.**

WOLCOTT, G. N. "Insectae Porto-ricensis" A preliminary annotated check-list of the insects of Porto Rico, with descriptions of some new species, *The Journal of the Department of Porto Rico*, Vol. VII, No. 1, pp. 5-313, 2 tab. San Juan P. R., 1924.

A systematic list of the insects recorded in Porto Rico up to the present, based on publications by numerous authors who have studied the entomological fauna of the island and on the existing collections at the Mayaguez and Río Piedras Experimental Stations.

Besides the detailed enumeration of insects already known, very many of which are important for agriculture, are included descriptions of various species new to science. The work also possesses a considerable bibliography and an index of the orders, families and genera to which the insects enumerated belong; the common Spanish names of the insects are also given. G. T.

748. Hymenoptera Parasitic on *Chrysomphalus dictyospermi* Observed for the First Time in the Maritime Alps (France) (1).

POUTIERS R. Les parasites du *Chrysomphalus dictyospermi*. Morg en France. *Comptes rendus des séances de l'Académie d'Agriculture de France*, Vol. X, No. 16, pp. 490-496. Paris, 1924.

Hitherto in the Maritime Alps no natural enemy of *Chrysomphalus dictyospermi* had been found (if *Chilocorus bipustulatus* L. and *Exochomus quadripustulatus* L. two Coccinellid predatory beetles, which prey on all species alike, are excepted), whose combined action is adequate to prevent the development of the lady-bird known, in France under the common name of "pou rouge".

During 1923, in the Mentone district, various Calcidid Hymenoptera parasitic on *Chrysomphalus dictyospermi* were observed for the first time. These are, in decreasing order of frequency: *Aphelinus chrysomphali* Mercet, *Aphel. maculicornis* Masi, *Aphel. borelli* Malenotti, *Aphycus flavus* Howard, *Prospaltella fasciata* Malenotti.

The first four are ectophagous parasites, the fifth is endophagous, In each case information is given regarding their discovery, their respective hosts and their present geographical distribution, and the author describes observations made by him regarding the three species of *Aphelinus* enumerated above.

From a practical point of view, the most important of the parasites of *Chrysomphalus dictyospermi* found at Mentone is without doubt *Aphel. chrysomphali* both because it apparently lives only on *Chrys. dictyospermi* and because its average frequency (56.9 %) is decidedly higher than that of the others.

Aphel. maculicornis comes second in importance but its average frequency is 23.7 % only. G. T.

749. Natural Enemies of the "Gypsy Moth" (*Lymantria dispar*) and of the "Oak Leaf Roller" (*Tortrix viridana*) in Spain.

DE LA ESCALERA, M. M. Nota sobre dos coleópteros que ataca a la *Lymantria dispar* y al *Tortrix viridana* en el Escorial. *Boletin de la Real Sociedad Española de Historia Natural*, vol. XXIV, No. 5, pp. 273-274. Madrid, 1924.

According to observations made at the beginning of May 1924, the two beetles *Xylodrepa quadripunctata* Schrober (fam. *Silphidae*) and *Calosoma inquisitor* L. (fam. *Carabidae*) both attack the caterpillars of the "gypsy

(1) See also *R.* 1918, No. 118. (*Ed.*)

moth" (*Lymantria dispar*) associated with those of the "oak leaf roller" (*Tortrix viridana*) on the oak trees of El Escorial near Madrid. *Xyl. quadripunctata*, which has hitherto been quite a rarity in Central Iberian fauna, has formed an important colony in the oak woods of Herrería below the dam on the Batán, and in four days it was possible to collect almost one hundred specimens.

In the author's opinion it would not be difficult to attempt the diffusion of this predatory beetle in the forest of El Pardo, where the caterpillars of *Lym. dispar* cause grave damage to the oaks.

Up to the present *Cal. inquisitor* also was rare in the El Escorial zone: the author has collected some twenty specimens of this second insect.

G. T.

750. **The Control of the "Olive Fly" (*Dacus oleæ*).**

"Moschicida" contro la mosca delle olive. *L'Agricoltura Toscana*, Year XVI, Part 11-12, pp. 167 168. Florence 1914.

The Director of the Royal Agricultural Entomological Station at Florence, Prof. A. BERLESE, has for some time realised the importance for olive growers to have at hand and ready for service, the mixture of molasses and arsenite of soda, required for the protection of olives against "fly", prepared in exact accordance with the formula he himself recommends which has been used experimentally in Tuscany and elsewhere for some twenty years. He has now arranged that the Granaiolo sugar factory at Empoli in the Province of Florence, should manufacture, under the name of "Moschicida" ("Fly killer") this mixture with a guaranteed content of over 90 % of molasses of consistency of 1.41, in the proportion of 40 to 45 of sugar to 2.5 of arsenite of soda. The compound is sold in barrels of 2 to 5 quintals or in tins of 25 kilograms. Every sample of this "Moschicida" is chemically controlled by Government through the Royal Agricultural Entomological Station.

The National Society of Italian Olive-Growers, which has its headquarters in Rome, has undertaken to receive orders for the mixture, which can now be obtained by growers at a considerably lower price than if home made. Moreover by using the "Moschicida" all danger of error in compounding the mixture is avoided, and also the possibility of speculation to the injury of the olive-growers. The mixture can be directly applied to the olives after simple dilution with water to a 10 % solution. It is estimated that the expense will not be more than about three *centesimi* per tree for each spraying. Only 300 grammes of the 10 % solution, equal to 30 grammes of "Moschicida" is used per tree for each spraying in accordance with the directions given as the result of practical experience. Thus over three thousand olive trees can be sprayed with one quintal of "Moschicida" at a cost of about 90 lire, including carriage.

G. T.

751. **Experiment in the Control of the " Olive Fly " *(Dacus oleæ).***

La labor efectuada por el Consejo Provincial de Fomento de Tarragona contra la mosca olearia en 1925, con la cooperación de los técnicos *Boletin de Olivicultura y elaboración moderna del aceite de oliva*, No 66, pp. 434-435. Tortona, 1924.

During 1923 an experiment in the control of the " olive-fly " (*Dacus oleæ*), by the Lotrionte method was completed at the farm situated in the district known as Camprédo (Municipal district of Tortosa, Prov. of Tarragon).

The following formula was used: 50 kg. of molasses which were afterwards replaced by honey, 100 litres of water, and 3 kg. of each of the other components (arseniate of soda, borate of soda, boric acid and glycerine). Three monthly sprayings were made.

The olive trees were associated with fruit trees, carobs, etc., and various parts of the farm were under vegetables.

The following results were obtained:

Protected zone . . . . . 25.2 % of olive trees attacked.
Unprotected zone . . . . . 79.2 %. » » G. T.

752. ***Euryphlepsia cocos* n. sp., Thysanopteron injurious to Cocoanut Palms, in the Island of Guadalcanar (Oceania).**

Muir F. On a new Cixiid attacking coconut palms (Homopt.) *Bulletin of Entomological Research*, Vol. XIV, part 4, p. 456, 1 fig. London, 1924.

Innumerable specimens of *Euryphlepsia cocos* were observed on cocoanut palms, on which they live, at Kow Kow in the southern end of Guadalcanar belonging to the Solomon islands group.

This Thysanopteron now described as a species new to science, was found attacked by a disease of cryptogamic origin. G. T.

753. ***Cephalolia elaeidis* n. sp. a Beetle living on *Elaeis guineensis* in Brazil.**

Maulik S. A new Hispid beetle injurious to oil palms in Brazil. *Bulletin of Entomological Research*, Vol. XIV, Part 3, pp. 245-246, 1 fig. London, 1924.

Description of the new species *Cephalolia elaeidis*, a Chrysomelid beetle reported in Brazil (Bahia) as living on the oil palm (*Elaeis guineensis*). G. T.

754. **Loss Percentage Caused by Sugar Cane Borer Moth in Lousiana during 1923.**

Heavy damage to sugar cane by borer. *Crops and Markets*, Vol. 1, suppl. 3, p. 86. Washington, D. C., 1924.

Probably the sugar-cane borer moth (*Diatraea saccharalis*) was importated into the United States in shipments of cane from South America

about 1857. At present the distribution is limited to the Gulf States and Lower Mississippi Valley.

This pest damaged the sugar-cane crop of the Louisiana sugar-cane belt in 1923 to the extent of 23 % of a full crop. In 1922 the borer's damage was 17 % ; in a normal year it is about 19 %.

The damage to sugar-cane by the borer has been found to fluctuate from year to year, due probably to weather and other conditions.

G. T.

755. ***Ansistrosoma* sp., a Beetle injurious to Sugar Cane, new to Peru.**

PORTARO, V. Una nueva plaga de la caña en el país. *La Vida Agrícola* Vol. I, No. 2, pp. 59-bis, 1 fig. Lima, Peru, 1924.

A beetle belonging, according to the Bureau of Entomology of the United States, to the South-American genus *Ansistrosoma* (fam. *Scarabaeidae*) is recorded as new to Peru, were it attacks sugar-cane. The species has not yet been identified.

This insect exists throughout the department of Lembayoque. It appeared and afterwards disappeared in the valley of Chicana (Cartavio). It was observed in Cajamarca and recently specimens were found in the valley of Carabayllo.

Its larvae, which live underground, feed on the roots of the sugar-cane.

A cane when first attacked appears to be retarded in its growth for want of water or heat ; but it is noticed that even when watered and also in summer the state of the plant does not improve. If the attack is not severe the cane puts out new roots, and though weak, continues to live. But when the number of larvae by which it is attacked is large, the plant languishes and finally dies.

Birds and ants are considered as the natural enemies of the beetle.

After the larvae have established themselves between the roots of the cane it is difficult to control them artificially. Early in the attack the most practical method is to keep the plant dry since the larvae die if during the early months of their life they are in compact soil devoid of moisture. If the attack is of some months standing it is advisable to keep the land fallow; however, as this means may be very costly it is preferable to introduce a concentrated solution of sulphate of copper under each plant after keeping the soil dry for a short time ; ten days later, water with nitrate of soda in solution is given to encourage growth. In the case of badly affected canes, the soil cannot be kept dry, because before the insect feels the lack of moisture, the cane, which already has its radical system weakened, cannot protect itself and may die.

It is easy to catch the perfect insect and the cost is relatively small. At dawn and in the evening it is found on the leaves and branches of trees near the sugar-cane. The author has in this way been able to destroy thousands of the adult beetles.

G. T.

756. ***Dendrothrips bispinosus* n. sp., Thysanopteron injurious to Tea, in Southern-India.**

BAGNALL, R. S. On a new injurious Thrips affecting tea in India. *Bulletin of Entomological Research*, Vol. XIV, part 4, p. 455. London, 1924.

Dendrothrips bispinosus n. sp., of which the description is here given, was recognised in 1923 as very injurious to tea in a plantation near Kotagiri (Nilgri Hills, Southern India). G. T.

757. ***Trioza buxtoni* n. sp. a Rhyncote injurious to Fig Trees in Palestine.**

LAING F. A new Psyllid injurious to fig. trees. *Bulletin of Entomological Research*, Vol. XIV, Part 3, p. 247, 1 fig. London, 1924.

The Rhyncote *Trioza buxtoni* belonging to the family of the *Psyllidae* which causes the formation of galls on the leaves of *Ficus carica*, is here described as a species new to science. It was observed at Ludd and Jericho in Palestine and is considered as a dangerous parasite which completely destroys many of the leaves of the host plant. G. T.

CURRENT NOTICES

Legislative and Administrative Measures.

758. **Brazil : Decree for the control of the sale of insecticides and sprays (19 Dec. 1923).** — It is obligatory that every container should bear a statement as to the composition of the contents and the method of use. The sale of a chemical product under a name different from the scientific or ordinary name is considered fraudulent.

A compulsory register, with no charge for entries, of all the manufacturers and salesmen of insecticides and sprays is established at the Chemical Institute. This Institute, in collaboration with the Chemistry Laboratories dependent on the Ministries of Agriculture, Industry and Commerce, and with the Laboratories of the States and Municipalities is responsible for the control of sales. The value of these products will be tested by the " Biological Institute of Agricultural Protection ", which will communicate the results to the Chemical Institute. The Biological Institute will keep a register of all reports. The Directors of this Institute, of the agricultural inspection and development Service, and of the Agricultural Chemistry Institute will fix the maximum percentages of the necessary ingredients and of impurities that may be contained in these products. (*International Institute of Agriculture, Section of Legislation, Legislative Texts of the Year* 1924. No. 3).

759. **Egypt : *Orthensia insignis* and *Aulacaspis pentagona* are scheduled as insects injurious to fruit trees (Order of 30 Dec. 1923).** — The sale of fruit trees and fruit shrubs infected by these insects is forbidden in all Egyptian territory. The Government of Alexandria is declared an infected zone from which all export of fruit trees or fruit is prohibited — exceptions can only be made on the authority of the Ministry of Agriculture. (*International Institute of Agriculture, Section of Legislation, Legislative texts of the Year* 1924, No. 2).

760. **France : Suppression of fraud in the Trade in Milk and Milk Products.** — For this purpose the decree of the 25th of March 1924 was issued which contains administrative regulations for the application of the law of the 1st of August 1905 concerning the suppression of fraud in regard to milk and milk products. This follows a series of decrees all issued with the object of defining in the interest of honest trade and public hygiene, the conditions under which different victuals and beverages should be sold.

Wine ; decree of Sept. 3, 1907, substituted later by the decree of August 19, 1921.

Beer, cider, vinegar, syrups, liqueurs; decree of July 29, 1907.

Mead; decree of May 2, 1911.

Fats and Oils; decree of March 11, 1908 supplemented by the decree of July 20, 1910.

The products of Sugar and Jam Factories; decree of December 19, 1910.

Preserves; decree of April 15, 1912.

Mineral waters; decree of January 12, 1922.

When the term *milk* is used cow's milk is intended; other types of milk must be specifically described. Milk is unfit for the use of man when taken from diseased cattle; the diseases will be specified in an order (arrêté) issued by the Ministry of Agriculture on the advice of the Consultative Committee on Cattle distempers; artificially coloured, unclean, or foul smelling milk taken from a cow earlier than seven days after calving, milk from badly fed or overworked animals is also unfit for human use. The sale of the milk of cows that have not been thoroughly milked is considered fraudulent as also, entirely or partly skimmed milk (20 gm. of fat to 1 litre) if not declared as such, milk stated to be pasteurized that has not been freed from all pathogenetic microbes by a process approved by the Superior Council of Public Hygiene of France, milk that is declared to be sterilized while containing living germs. It is considered to be adulteration to mix milk with water or any other substance, with the exception of such substances as are authorized for the preservation of milk by an order issued with the consent of the ministries of hygiene and agriculture, on the advice of the Superior Council of Public Hygiene of France. For cleaning and disinfecting the utensils used for manipulating, transporting and the retail sale of milk, the use of alcaline carbonates, hypochlorites, formaldehyde and oxygenated water is allowed, on condition that the passage of these substances into the milk is obviated by thorough cleansings.

In the manufacture of *condensed milk* only milk fit for the use of man can be used. It is obligatory to declare the date of manufacture and the degree of condensation. Only four denominations are allowed: condensed milk, condensed and sugared milk (which can only be manufactured with unskimmed milk), condensed skimmed milk, condensed skimmed and sugared milk. If the sugar is different from cane-sugar, even if only in part different, the fact must be stated.

The same rules are applied to *milk powder*.

The denomination of *casein* is reserved for the albuminoid substance of skimmed milk obtained from draining and drying the curds of completely skimmed milk. The use of bicarbonate of soda and phosphate of soda is allowed, provided it does not exceed 8 % of the weight of the dried casein. The casein for human use must be odourless and not unpleasant in taste.

Cream must contain 30 % of fats; diluted cream (with skimmed milk) at least 15 %.

Any addition of substances to cream is considered fraudulent unless for purposes of preservation, and all that is said above about milk is applicable to cream.

Butter must not contain more than 18 % of non fatty substances, among which not more than 16 % of water. Butter may be coloured by vegetable

substances ; also salting is allowed if not over 10 % of commercially pure salt is used (the declaration of this fact is obligatory), the addition of small quantities of saltpetre and sugar is permitted ; the remaking of butter is also allowed if done by working it over in milk or water with a small addition of bicarbonate of soda, the butter being expressly labelled as remade. The water used in the making of butter must be good drinking water. All that has been said above about milk applies to butter, as far as concerns the preservation of ingredients and the cleansing of utensils.

Cheese containing less than 15 % of fat must be sold under the title of "skimmed milk cheese" excepting cheeses that are customarily made of skimmed milk. Any cheese made of milk other than cows' milk must be so declared unless of an obviously different type. The "double cream cheese" must contain at least 60 % of dry fats, the whole milk cheese at least 40 %.

Salt, herbs, spice, ferments and coloring moulds are allowed to be used in the mixing of the cheese paste ; bicarbonate of soda may be used for salting the cheese externally, and the use of paraffin, incorporation of fats other than butter is allowed as long as the kind of fat used is declared.

The title of *rennet* is reserved for the liquid or thick extract derived from the maceration of the stomach membrane of an unweaned calf. Commercially pure salt, boracic acid, and salicylic acid may be added when used for preservation purposes, provided that the strictly necessary proportions are observed. (*Decree of the Agricultural Information office, Ministry of Agriculture*, No. 13, 1924).

761. **Means taken to extend sericulture in France and the French Colonies.** — At the first session of the Supreme Council of Sericulture it was decided to proceed to an enquiry into the encouragement given to sericulture in France, Algeria and the French Colonies. It was decided to study the best means for developing sericulture and in particular to initiate a study on the spot in Algeria, so as to discover the parts of the country most suitable to this industry. The Department of sericulture has been requested to publish a manual of propaganda.

In order to encourage the development of sericulture in the Regency, the General Directorate of Agriculture and Commerce for the colonies distributes, free of charge, a large quantity of silk-worm eggs to any person who makes application to the Directorate of Agricultural Services in Tunis ; the amount being in proportion to the quantity of mulberry leaves which are available for the breeders. The administration also insures the sale of the cocoons produced. (*Les Cahiers coloniaux de l'Institut de Marseille*, No. 277, 1924).

762. **Italy : Consolidated text of laws for the draining of marshes and marshlands,** issued and approved by the R. D. Dec. 1923, No. 3256, published in the *Official Gazette*, No. 71, March 24, 1924.

763. **Norway : Rules for forage packing.** — It is prohibited to import forage for cattle (flours, cake, brans, indian corn, etc.) in already used sacks, unless : (1) the forwarding agencies present a certificate with the visa of the Norwegian Consul, stating that the sacks are new or have only been used for the raw material with which the forage has been made or else for sugar or (2) the forage has been on the voyage for more than seven weeks at least. (Circular of the Ministry of Agricultures of Norway of the 10th of March 1924,

relating to the packing of cattle feeds. (*Bulletin of the Information Office of the Ministry of Agriculture*, No. 17, p. 315, Paris, 1924).

764. **Union of South Africa: Order for the prevention of the introduction and spread of diseases and pests among cultivated crops.** — (No. 1, 1 February 1924). The importation of plants and seeds, unless sent by parcel post, must be made through Port Harold (unless a special permit is given by the Government) where they are disinfected by fumigation at the expense of the importer. (*International Institute of Agriculture, Section of Legislation, Legislative texts of the year* 1924, No. 4).

765. **Decree for the protection of wild birds in South Africa.** — No. 7 February 1, 1924). A list is given of wild birds for which the districts and periods of the year in which shooting is prohibited are fixed. The institution of bird reserves is proposed. Special licences can be obtained for scientific purposes. (*Ibidem*, No. 5).

Experiment Stations and Agricultural Instruction.

766. **Experimental Institute for Milk in Kiel.** — The "Preussische Versuchs- und Forschungsanstalt für Milchwirtschaft" was inaugurated in Kiel (the centre of the German milk industry) in 1922 under an arrangement with the local Chamber of Agriculture of the Prussian State (Landwirtschaftskammer) which granted the land, the "Milchwirtschaftliches Institut" and other institutions. The aim of this new organisation is (1) scientific research on all questions relating to the milk and milk products industry, with the special purpose of solving their particular problems; (2) expert assistance for the milk and milk products industry; (3) instructional work. It is divided into six sections: Chemical — bacteriological — physical — milk production — manufacturing processes — dairy machinery. Attached to this establishment is a model dairy, capable of working from 10 to 12,000 litres of milk a day, and an experimental farm at Friedrichsort. (BÜNGER, *Zeitschrift für Fleischund Milch-hygiene*, Vol. 9, 1924).

767. **Moving pictures in propaganda for stock-breeding industries in Germany.** — In 1924 the "Universal Film A. G." (Ufa) of Berlin founded partly at the request and with the help of the authorities of the Agricultural Services an instructional section ("Kultur-Abteilung").

This section has shown a great number of films of agricultural interest, especially on behalf of various industrial firms producing agricultural machines and tools, selected seeds, manures, etc., and for demonstrations in connection with the most important crops. To these have been added lately fifty-two films for propaganda in the stock-breeding industry, devoted more particularly to cattle, but also to swine, horses, dogs and sheep. In giving this information Herr A. KÜHNEMANN (*Mitteilungen der Deutschen Landwirtschafts-Gesellschaft*, Year 30, No. 52, pp. 660-666) states that the catalogue of Ben Blumenthals (one of the largest firms in the U. S. A. for lending films) includes 1800 agricultural films, of which 1200 relate to stock-breeding.

768. **Armenian University.** — The Armenian Republic has founded a University at Arivan.

769. **Model dairy of the White Cross of Vlesenbeke (Brussels).** — The cow sheds are 3.75 m. in height, well lighted, with windows looking to

east and west : the stall for each cow has an opening for ventilation ; behind each row of stalls there is a small canal about 20 to 30 cm. lower than the floor, which collects all dejecta and carries them away in a constantly flowing stream of water ; the walls are washed down by water under pressure ; the kitchen for the animals is connected with the stables by a rail-track ; the rations are composed of fodder, beet, cake and flour (fermented food being excluded), in proportion to the requirement of each cow, which has an automatic and individual trough. Milk is drawn so as to avoid contact with the air and is collected into pans which are hermetically closed by reduced pressure. In the receiving room the milk is weighed, a sample is taken for analysis, it is filtered through aseptic cotton-wool and is then carried to the cooling apparatus where it is kept at 4°.

All these operations are carried out by mechanical means so as to avoid the milk coming into contact with the hands of the workmen. (*Bulletin de l'Office de Renseignements agricoles*, No. 17, 315, Paris, 1924).

770. **Agricultural Propaganda Service (" Serviço de Propaganda Agricola ") organised by the Agricultural school of Lavras (Minas Geraes, Brazil).** — This service covers : distribution of agricultural publications, consultations by correspondence, instruction by correspondence, preparation and distribution of drawings, photographs, maps, agricultural films, visits to farms ; cooperation in agricultural experiment, propaganda campaigns for special agricultural problems and cattle rearing. (*Agricultura*, Year III, No. 11, Lavras, 1924).

771. **School for cultivating tea in Ouro Preto, Minas Geraes.** — For the encouragement of the development of the cultivation of the tea plant in the State, the Government of Minas Geraes has established in Ouro Preto in the grounds of the former botanical gardens an " Aprendizado Agricola ", especially devoted to the cultivation of the tea plant and the working of the crops. Care has been taken to restore the existing plants (see *R.* 1924, No. 87) and for establishing new plantations, 100 thousand Assam and China plants have been provided.

The scientific preparation of the first crops with the use of simple machinery, gave a perfect product as regards taste and aroma. (*Brasil-Ferro-Carril*, Year XV, Vol. XXVI, No. 340, p. 394. Rio de Janeiro, 1924).

772. **Importation of Java varieties of sugar cane to Brazil.** — " The Biological Institute of Agricultural Protection has obtained from the experimental station for sugar cane of Pasoeroean (Java), specimens of cane of the best local varieties as a result of requests made by the Brazilian Ministry of Agriculture. They will be grown in the Experiment and Demonstration Ground of the " Biological Institute " in Deodara so that it may be possible to distribute shoots among the Experimental stations of the States of Rio, Bahia and Pernambuco. (*Brasil-Ferro-Carril*, Year XV, Vol. XXVI, No. 240, p. 395. Rio de Janeiro, 1924).

773. **" Fumo X amarello ", a variety of tobacco obtained by selection in the State of Bahia.** — In the " Campo di Ondina " Dr. Achille Splendore engaged by the Brazilian Ministry of Agriculture, has obtained by selection a valuable kind of wrapper tobacco for good quality cigars, namely, " fumo X amarello ". The seeds have been distributed among the planters

by the "Serviço agronomico da Bahia" (*Brasil Ferro-Carril*, Year XV, Vol. XXVI, No. 345, p. 523, Rio de Janeiro, 1924).

774. **An experimental station for cocoa** is being organised in the "Diamante" estate of the Municipality of Ilheos, State of Bahia, Brazil.

775. **Forest plantations in the State of Minas Geraes.** — One of these plantations is established near Bello Horizonte and has already distributed many thousands of young plants for purposes of afforestation. Another plantation is proposed for the southern part of the State. Wood fuel in Brazil competes favorably with native and with English fossil coal: the "Estrada de Ferro Central" uses wood for fuel. In view of the necessity for providing sleepers and wood for the railroads the "Companhia paulista de Estradas de Ferro" has carried out and continues to carry out, a large amount of afforestation work. A. DE SILVEIRA, *Chacaras e Quintaes*, Vol. 59, No. 3, San Paolo, 1924).

776. **Stock-breeding Institutes of the State of San Paolo.** — In the "Posto de Selecção" of Nova Odessa, which has been enlarged and has taken the name of "Fazenda de criação e de selecção" were concentrated in 1922 various isolated "Postos de selecção" and "Fazendas de criação" in different parts of the State, which had no means of communication, thus making it difficult to carry out complete inspections for the purpose of comparing the various types bred. The stations that have been abolished still exist as service stations. Special attention has been paid in Nova Odessa to the breed of "Caracú".

In the "Fazenda de Criação of Boa Vista, Dutch Herefords are bred.

In the "Fazenda de Criação Campininha" selection of the "mocho nacional" breed (type without horns) is practised. The "Fazenda de criação, rears the Red Rolled breed".

In the "Fazenda de Criação" of Itapetininga the "Red Marsh" breed is reared.

The "Postos Zootechnicos" of San Paolo and Botucatú, "Haras Paulista" are responsible for improving the national breed of horses, by means of foreign thoroughbred stallions including: English, Arab, Anglo-Arab, etc; they possess four hundred and fifty-two animals.

The State has a veterinary police service ("Serviço de Policia Sanitaria Animal") and laboratories. (*O Creador Paulista*, Year XVIII, No. 7, pp. 85-87, São Paolo).

777. **A sericulture service in the State of Minas Geraes.** — In November 1923, a "Serviço de criação do biche da seda" was established by the "Escola Domestica" of Passa Quarto, Minas Geraes.

778. **The Agricultural experimental station of Santiago in Chile** is being organised, and will be directed by Señor RAMÓN CLAVEL. It will have 19 ha. of ground and a laboratory for the preparation of serum and vaccine.

779. **Botanical garden of Harvard in Cuba.** — About twenty years ago Mr. E. F. ATKINS gave to Harvard University, Boston Mass. U. S. A. a part of his property at Soledad near Cienfuegos (Cuba) for conversion into a botanical garden of tropical plants, which would be of particular value for selection work. The general direction was entrusted to Mr. K. M. GREY, Professor D. L. GOODALE and O. AMES acting in collaboration with Mr. ATKINS. The Gar-

den receives continual additions and now contains a collection of 2,000 specimens of tropical plants brought from all parts of the world, and a specimen of every kind of tropical fruit. Especially important are the collections of mangoes, limes and custard apples as well as many hybrid species of sugar cane, limes, cotton plants, mangoes, guavas etc. on which experiments have been made. The seat of the Station affords a rich field for the study of botany and of all branches of biology. · (*Science*, No. 1533, 1924. New York).

780. **Experiments relating to plant cultivation and the trade in controlled seeds in Denmark.** — The following notes are supplied by the Royal Society of Danish Farmers.

In Denmark experimenting on cultivated plants is largely practised, partly by the experimental stations and partly by the Agricultural Societies ; these last are named "local trials", that is to say they are of brief duration usually for one year only and are made on private properties, either for educational purposes or for direct use on the spot. The experiments made under official auspices began in 1870 only, and were started by P. NIELSEN of the Royal Society of Danish Farmers ; they are now entirely made at the expense of the Government which contributes for the purpose 600,000 Danish crowns per annum.

The Experimental Section ("State Experiment Department for Plant Culture") is under the supervision of the "State Board of Plant Culture" which is composed of five members appointed respectively by the Royal Danish Society of Farmers, the Federation of Danish Agricultural Societies, the Federation of the Society of Small Holders of Denmark, the Royal High School of Agriculture and the Horticultural Societies. These nominations are subject to the approval of the Ministry of Agriculture.

The investigations are carried on at the experimental stations, and are completed by laboratory work. The area of each station averages 20 to 40 ha. or over.

The following stations and sections are at present under the control of the Experimental Division :

Experimental Agricultural Stations : (1) Tylstrup (North Jutland) with a substation for experiments in peat soil at Store Vildmose ; (2) Studsgaard (Central Jutland, near Herning(with an area also in West Insland (near Borris) and substation for experiments in peat soil near Herning ; (3) Askov in South Jutland ; (4) Aarsolev in Funen ; (5) Lyngby on Bornholm ; (6) Tystofte in South-west Seeland with a substation at Abed in Lolland.

Stations for horticultural experiments : (1) Hornum in the East of Jutland ; (2) Spangsbjerg in the south-west of Jutland (near Esbjerg) ; (3) Blangsted in Funen (near Odense).

There are also special sections for experiments in cultivation in marshy soil, experiments on root plants, for getting rid of weeds, for investigating forage, for controlling plant diseases ; this last section having a laboratory at Lyngby.

Laboratory researches are partly and principally made in the State crop laboratories at Lyngby, where experiments to prove the need for lime in the soil are also made and also bacterial cultures for the inoculation of leguminous plants.

The experimental station at Hiving near Thorshavn (Faroe Isles) is controlled by the Experimental section.

The work of the various stations is, to a certain extent, specialised. Thus manurial experiments are made at Aarslev (clay soil), at Askov (sand-clay soil and sandy soil) and Studsgaard (sandy soil); potato trials at Tystrup; experiments in plant selection at Ystofte and at Abed.

Each trial is repeated from 5 to 20 times on 5 square metre plots per are according to the nature of the experiment, and to the degree of soil homogeneity, etc. Each experiment lasts for several years and is made simultaneously at several stations under a common scheme of work established yearly.

At the conclusion of each experiment the result is published in the Gazette of the State Committee of Cultivation, *The Tidsskrift for Planteavl* (Gyldendalske, Boghandel, Nordisk, Vorlag, *Copenhagen*). Usually it is followed by a short summary in English.

The State station for seed testing at Copenhagen inspects the seeds and co-operates in the experiments, examining the seeds used.

The local cultivation experiments are made through the initiative of the Agricultural Societies and to a lesser degree by the horticultural organisations. Beside the Royal Society of Danish Farmers, there are 137 Agricultural Societies in Denmark (Landeboforeninger) with about 115 thousand members and 1162 agricultural societies of small holders (Husmandsforeninger) with about 81 thousand members. For the carrying out of experiments and other methods of encouraging the development of crop cultivation, the agricultural societies singly or in groups nominate local crop committees which engage experts for carrying out experiments. The agricultural societies and the small holders co-operate separately in each district, under the direction of a district crop committee, which at the same time engages experts and publishes annual reports which deal with the experiments and other methods of encouraging agriculture in the district. These Committees co-operate with the State Experimental Section.

Local experiments were initiated in Denmark in 1890 and now more than 3 thousand are carried out yearly. In the beginning these experiments were almost entirely confined to the use of chemical manure and even to-day they are still largely devoted to this question but include also any problems that may arise in connection with crop cultivation.

Local experimental work is paid for by the agricultural organizations, but the State refunds 40 % of the cost (formerly 50 %). The State spends about 600,000 Danish crowns annually under this heading.

In the work carried out by the State Experiment Station experiments relating to the varieties and types of cereals, especially root plants, clover, forage crops and vegetables have an important place. The object of these experiments is threefold: (1) to indicate the best species, for obtaining the best possible harvest; (2) to encourage the increase in the productivity of the species; (3) to give greater stability to the trade in seeds. Before carrying out a series of these experiments on various lines (in which foreign lines are also included for purposes of comparison), a public invitation to participate is issued. All can compete under certain conditions. The experiment is entirely

at the expense of the State, and lasts for a certain number of years. The results are published in the *Tydsskrift for Planteavl.*

The Royal Society of Danish Farmers ("Det Kongelige Danske Landhusholdningsselskab", Vestre Boulevard 34. København B) gives information as to the Danish varieties and lines which are considered to be most profitable and furnish small samples of their seeds free or at a moderate price. If requested it co-operates in the trials, made in Denmark, on foreign varieties as far as circumstances allow.

The Seed Testing Station Statsfrøkontrolen, København, reports on the purity of the seeds, the percentage of weeds, their germination power (velocity of germination), capacity for germination, and when possible the genuineness of the species and lineage. If the contract for the purchase of seeds was signed with the understanding of a right to indemnity according to the rules of the station for seed control, the buyer has the right to the indemnity if the seeds have a high percentage of impurity or low germination power. If requested the Station makes out the figure that must be paid back. The indemnity for wrongly described products is settled by a court of arbitration composed of a representative of the buyer, one of the seller and one selected from the Committee for the control of seeds who is in the pay of the Ministry of Agriculture.

The rules for compensation and the rules for controlling the seeds and roots plants, can be obtained from the station for seed control. (Danish experiments in plant culture and details about the trade in controlled Danish seed. Reprinted from *Tidsskrift for Planteavl* 1923).

781. **Schemes for enquiry by the Agricultural Experiment Stations of the U. S. A. in 1922-1923.** — These schemes were 5156 in number or an average of 103 per station including 56 which were purely of an administrative character for control and regulation, the remaining 5100 were for agricultural research and experiment. To these may be added 140 carried out at the island stations of Alaska, Guam, Hawaii, Porto Rico and the Virgin Islands which bring the total up to 5240. As some of these schemes include one or more questions for investigation, the actual list covers 5756 experiments which may be grouped as follows, field crops 1611 (Indian corn, 183, potatoes, 153, wheat 143, etc.) — horticulture and arboriculture 904 (apples, 118, fruit trees in general, 61, garden produce in general, 61, etc.) — plant diseases 452 (potato diseases, 51, diseases of cereals in general 34, diseases of apples 32, etc.), economic entomology, 412 (bees 45, insecticides 39, etc.) — soils, 310 (fertility of soil, 46, flora of the soil 38, kinds of soil 29, etc.) — veterinary medicine, 194 — fertilizers, 193 — rural economy, 186 — swine, 180 — milch cattle, 176 — poultry rearing, 170 — rural engineering, 162 — botany, 133 — fodder and cattle feeding, 111 — milk and milk products, 93 — butchers beasts, 88 — sylviculture, 82 — chemistry, 76 — chemistry, 105 — sheep, 74 — food stuff for human consumption, 50 — economic zoology, 30 — seeds, 28 — bacteriology, 22 — noxious weeds, 19 — stock breeding in general, 15 — horses and mules, 14 — meteorology, 11 — agricultural science, 10. (*U. S. A. Report Service, Office of experiment stations.* A classified list of schemes carried out by the Agricultural Experiment Stations, 1922-1923, pp. 364, Washington, 1923).

782. **The teaching of household economy in the junior classes of**

the primary schools in Angers, France. — M. DECHAMBRE has presented to the Agricultural Academy of France a memorandum by M. MAILLET, municipal veterinary officer of Angers, on the subject of teaching rural domestic economy in the girls' primary schools of the town. Three groups of scholars are having theoretical and practical teaching: (1) orphans supported at the public expense who are trained as village servants or housewives, (2) scholars in the higher classes of the elementary schools who are trained to become housewives in the country; (3) pupils who are preparing for teaching in the elementary schools.

The results obtained so far with the special methods of teaching, which differ for each group, are very satisfactory, though the funds available are limited. (*Reports of the French Academy of Agriculture*, Vol. X, No. 20, 1924).

783. **Station for line selection of wheat in the Central Massif of France.** — This station is situated in Lafont near Riom, Puy-de-Dôme and was established by the Federation of Agricultural Syndicates in the Department. In a report lately published the director M. F. BEAUVERIE reports on the work of the season of 1922-1923. This includes 1800 specimens of wheat lines of the departments of Puy-de-Dôme, Loire, Haute-Loire, Aveyron, Cantal, and also ryes of Cantal and of the Loire.

Various comparative studies have been made of lines and seeds as regards *Puccinia glumarum* and other rust forms which appear less frequently in the region of the Station. (*Journal d'Agriculture pratique*, Year 88, No. 25, pp. 490, 1924).

784. **Stock breeding experiments in France.** — The National centre of Stockbreeding experiment was established in 1919 in the property of Vaulx-de-Cernay (Seine-et-Oise) belonging to Baron H. ROTHSCHILD. This centre, of which the director is M. Maurice LAPLAUD, was requested by the "Office Agricole Regional du Nord" to make experiments on horses, cattle, sheep, swine and poultry. The results of the experiments so far made have been collected in a volume lately published. The following is the list of these reports:

P. DECHAMBRE and E. DEGOIS, *Opérations de la boucherie du centre national zootechnique en* 1920.

LAPLAUD, *Comparaison du prix de revient d'un kilo à 15 ans avec tracteurs, chevaux et bœufs.*

LAPLAUD, *Expérience d'engraissement des bovidés, en* 1920.

LAPLAUD and GARNIER, *Notes pour servir à l'histoire de la race ovine de la Charmoise* (1910-1920).

LAPLAUD, *L'engraissement des volailles du domaine de Vaulx-de-Cernay.*

DECHAMBRE and DEGOIS, *Sur la valeur du cinquième quartier en boucherie.*

VOITELHER and DEGOIS, *Recherches expérimentales sur le croisement industriel Southdown Limousin.*

LAPLAUD and BRUNET, *Notes sur la pigmentation chez les gris. La valeur des pedigrées.*

F. BRUNET, *Le 2e Concours national de ponte.*

LAPLAUD and BRUNET, *Observations sur l'indice d'appétence et la valeur des rendements chez les bœufs Charolais et Limousins de 2 à 3 ans* (IE 1923, No. 78).

DEGOIS, *L'emploi aux reproducteurs chez les jeunes gondonneaux*

LAPLAUD and DOFFAU, *Etude sur le poids des agneaux à la naissance.*

Charles VOITELLIER, *Recherches expérimentales sur le croisement industriel Charmois-Limousin.*

785. **Work of the Central Committee of Motoculture in France during the year 1923.** — The Central Committee for the study of mechanics has given special attention to the discovery of a carburant so that a national and less expensive product may be substituted for petrol for use with agricultural machines. The Committee worked in collaboration with representatives of the Ministry of War and of the Colonies, " L'Office National de Recherches et Inventions ", and " L'Automobile Club de France ". The carburants that were to be studied directly were those of poor gas (produced by the combustion of a mixture of wood and wood charcoal) and vegetable oils.

Upon the suggestion of the Central Committee, the Ministry of Agriculture has established two series of studies: (1) Experiments with Agricultural traction machines furnished with gas generators employing wood and wood charcoal (decree of May 28, 1923); (2) a competition for motors working on oil and of carburants with an oil basis (decree of June 20, 1923).

The first series of studies was made in field trials conducted at Essenes-Corbeil (Seine-et-Oise) in September 1923 and in shop trials in the workshop of the Automobile Club de France at Neuilly, in October 1923. The reports on the work carried out were published by the Agricultural Library of the *Maison Rustique*, 26 Rue Jacobs, Paris IV.

The competition for oil motors took place in the spring of 1924.

786. **The Institute of Tobacco-growing in Drama (Thrace, Greece).** — This Institute was inaugurated in 1923 and is financed by the State and other bodies. Its objects are the improvement of the quality of the tobacco by means of improved seeds, the control of diseases and scientific sorting of the tobacco to obtain regular fermentation (*Der Tropenflanzer*, Year 27, No. 1, pp. 24-25. Berlin, 1924).

787. **Italy. Technical instruction for the peasants.** — The Directorate of Agriculture at the Ministry of National Economy is organising technical instruction for the peasants. Instruction will be given to all those who have passed through the elementary classes and the schools will be founded in every commune where there are many small holders, metayers etc. The instructors will be specially trained rural elementary schoolmasters who will be selected from the holders of the diploma of the intermediate Agricultural schools and must have had practical farm experience in the province for not less than three years. After they have fulfilled their duty in regard to the instruction of the young peasants these instructors will be able to assist in technical propaganda as well as in economic and co-operative society work under the control of the " Cattedre ambulanti d'Agricoltura " (travelling agricultural schools). The cost of this instruction is calculated to be about 2 million liras for e1924-1925, hree millions for the 1925-1926, 4 millions for 1926-1927 and fiv millions int the following years.

788. **Institute of Agricultural Ecology.** — An Institute of Agricultural Ecology has been founded under the auspices of the Royal Academy "dei Lincei" (Rome) for the purpose of conducting experiments relating to the study of the physical environment in relation to the development and the productivity of

plants in all parts of the world. In 1923 an International Commission of Agricultural Ecology was appointed under the Patronage of the Academy. At its meeting of February 12, 1924, the Executive Committee of the Commission approved the programme of work for 1923-1924 proposed by Prof. R. Pirotta (President of the Commission) and by G. Azzi (Secretary) which deals with the following subjects: (1) The principales of agricultural ecology; (2) the ecological problem of wheat; (3) the international system of stations for agricultural ecology (*Nuovi Annali di Agricoltura*, Year IV, No. 2. Rome, 1924).

789. **Electrogenetic Laboratory, Belgirate, Milan.** — This laboratory was inaugurated on June 15. The studies initiated by Prof. Pirovano will be continued. (See *R.* 1923, No. 556).

Congresses and Conferences.

790. **Fourth International Conference of Pedology.**

Retrospective review — The necessity for a permanent international collaboration regarding the scientific and practical side of field geology has been the occasion during the last twenty years, of numerous reunions of famous technical experts of the various nations and in this way helped towards an ever increasing development of the new science which was in process of formation, to which the name of " pedology " is given, having special regard to the intimate connection between the agricultural qualities of a district and the prevailing conditions as regards genetic selection and environment.

As early as 1909 the first international conference of field geology was held in Budapest on the initiative of the Royal Hungarian Geological Institute and in the following year a second Conference took place at Stockholm under the presidency of the General Secretariat of the XIth International Conferrence of Geology. As many as 170 pedologists, and officially 19 nations took part in this second Conference as a result of which three International Commissions were appointed: (1) for an inquiry into field geological conditions and the studies made on the subject in the various countries: (2) for the preparation of soil extracts for chemical analysis; (3) for various questions of nomenclature.

The third International Conference, which should have been held at St. Petersburg in 1914, could not be arranged for the original date appointed owing to insurmountable local difficulties and also, because of the war, it was impossible to hold it at Rome as was then proposed. It was not till 1922 that, thanks specially to the efforts of Dr. Hissink of Groningen and of Prof. Dr. Kopecky of Prague, it was found possible to hold the Conference in the latter city from the 19th. to the 24th April. This third pedological Congress thus linked up again the international relations which had been interrupted for several years.

At the Prague Conference, which in a sense had to establish the preliminaries for the convocation of a IVth Congress, the Commissions appointed in 1910 at Stockholm were increased to five: (1) for the mechanical and physical analysis of the soil (President, Prof. Dr. J. Kopecky of Prague) with a subsection for the study of pedology in relation to rural hydraulics (Director Col. J. Gisseinger of Zurich); (2) for the chemical study of the soil (President, Prof. Dr. A.

A. J. von Sigmond of Budapest) ; (3) for bacteriological and biochemical soil study (Presidents : for Europe and Africa Prof. Dr. J. Stoklasa of Prague ; for America and Asia Prof. Dr. J. G. Lipman, New Brunswick) ; (4) for the nomenclature and classification of the various soils (President, Dr. B. Frosterus, Helsingsfors) ; (5) for soil mapping (President, Prof. Dr. G. Murgoci of Bucarest).

Organisation of the IVth Congress. — The conference which, on the proposal of the Italian Delegate, Dr. Borghesani, in the name of the " Società Agronomica Italiana " it was decided to hold at Rome in the spring of 1924, was organised under the auspices of the Permanent Committee of the International Institute of Agriculture, on the invitation of the international Secretariat of Pedology, and an office was opened at the Institute for the Secretariat of the Italian organising Committee. This Committee, of which the Chairman was Prof. De Angelis d'Ossat (Perugia) invited the co-operation of Dr. Saulnier and Dr. Borghesani, respectively Chief of Service and Chief of Section in the Institute, who specially undertook responsibility for the organization of the Congress. Prof. Perotti was elected to the office of Secretary in Rome

On Nov. 30, 1923 a preliminary circular of invitation was sent out for the IVth Conference to some 3,000 pedologists and pedological Institutes throughout the world and shortly after an invitation was sent to the Governments, whether adherent to the Institute or not, to nominate official Delegations.

Parallel with the international Committee of Pedology different national Committees (American, French, Polish, Swedish and Hungarian) were constituted and to the five International Commissions formed at Prague, a sixth was added for the study of plant physiology in its relation to pedology (Secretary, Dr. K. Zijlstra X. of Groningen) whilst in the 4th Commission — for nomenclature — Prof. C. F. Marbut of Washington D. C. was elected president for America. At the same time an Executive Committee was formed for preliminary work in connection with the foundation of the " *International Association of Pedology* ".

In the meanwhile His Majesty the King of Italy and His Excellency the Hon. Mussolini had granted their high patronage to the Congress and His Excellency Signor Corbino, Minister of National Economy had accepted the Presidency of the Committee of Honour. Some 22 States and sixty Scientific Institutes had announced their intention of sending their official representatives to the Congress, which was supported by about 400 pedologists from all parts of the world.

Among the latter were the most illustrious representatives of the various branches of Agricultural Science, including Proff. E. Ramann (Munich), G. Anderson (Stockholm), K. Glinka (Petrograd), Winogradsky (Paris), A. A. V. Sigmond (Budapest), R. Gannsfn (Berlin) G. W. Robinson (Bangor), J. Stoklasa (Prague) G. Murgoci (Bucarest), J. G. Lipmann (New Jersey) etc. etc.

Thus under the patronage of the International Institute of Agriculture an important international scientific assembly, famous on account of the scientific reputation of its members, was held for the first time.

Inauguration of the Congress. — On May 12th 1924, in the main hall of the International Institute of Agriculture, the IVth International Conference of Pedology was opened in the presence of the King. His Excellency Signor SARDI, Under-Secretary for Agriculture, and other political and scientific personalities as also the American, Belgian, Czecoslovakian, Danish, Egyptian, Finnish, French, Georgian, Japanese, English, Irish, Indian, Yougoslavian, Lettish, Norwegian, Dutch, Polish, Rumanian, Russian, Spanish, South African, Swedish, Swiss, German, and Hungarian delegates.

After opening addresses by M. LOUIS-DOP (vice-president of the International Institute of Agriculture), Count FERRARI, representing the Municipality of Rome, His Excellency, Signor SARDI, for the Italian Government, and Prof. DE ANGELIS D'OSSAT, to which the delegates of the various Nations replied in suitable terms, and after a report by Dr. HISSINK on the work of the General Secretary for Pedology, the following were elected as officers of the Congress: Honorary President: Prof. Dr. E. RAMANN (Munich); acting presidents: Professors G. ANDERSON (Stockholm), J. KOPECKY (Prague), and G. DE ANGELIS D'OSSAT (Perugia); and general secretary Prof. R. PEROTTI (Rome).

Lectures. — During the Conference, general lectures were given respectively by Prof. G. ANDRÉ (Paris) on manuring and its agricultural effects, by Prof. B. A. KELN (Rothamsted) on recent researches in soil physics, by Prof. G. WIEGNER (Zurich), on dispersoidal chemistry in connection with pedology, by Prof. J. STOCKLASA (Prague) on the modern aims of experiments on bacterial activity in the soil, by Prof. WINOGRADSKY (Paris) on the methods of bacteriological investigations of the soil; by Prof. J. G. LIPMAN (New Brunswick N. Y.) on the fertilizer industry in the United States in relation to soil science and Prof. A. MENOZZI (Milan) on soil analysis and its value.

Work of the Commissions. — The work of the Commissions began on the second day of the Conference, and the opportunity was thus given of examining and discussing numerous reports by experts in various branches of pedological science.

The I and II Commissions first considered the question of the "*preparation of samples of soil for mecanical analysis*", and the speaker, Dr. NOVAK (Brno), called attention to the differences in results which were being obtained by the methods of preparation adopted.

Prof. SIGMOND (Budapest), after a discussion, in which Dr. HISSINK (Groningen), Dr. RAMANN (Munich) and Dr. ROBINSON (Bangor), took part, summarized the results of the studies made on this question and the proposals made for a simple conventional method for the preparation of soil extract by the use of the HCl concentrate.

Dr H. BERGER (Zurich), was of opinion that before undertaking special soil experiments, it is necessary to have a clear idea of the structure and of the general composition of the soil under examination and reported the results of his own experiments on soil *in situ* by means of the cylinder method. The investigation of the capacity for admitting air and for water percolation, would give an adequate idea of the structure of the soil, and the determination of these two physical qualities would suggest, as it has already sug-

gested, the solution of numerous problems, especially in connection with tree planted soils, which could not be solved in any other way.

Dr. H. LUNDEGARDH (Lund, Sweden) reported on "*a new method for determining soil areation*", based on the speed of diffusion of carbon dioxide. The aeration K would be given by the quantity in cubic centimetres of CO_2 which diffuses itself in one second through a cylinder of earth, one centimetre in length and with a base of a square centimetre, the difference of tension being 1 atmosphere.

Prof. SVEN ODEN (Stockholm) discussed the general principles of the "*determination of the distribution of mineral particles in the soil in relation to their size*", and of interpreting with their assistance the different methods in use. The practical expedients employed by the writer in the laboratory were described in a separate report by Dr. B. A. KEEN on "*An improved self-registering balance (balance Oden-Keen)*", and in another report by ODEN himself on the "*Structure and properties of some Swedish soils*" the author, in discussing the idea of "plasticity", pointed out the importance of the factor "time of deformation" and, correlatively stated that, for ascertaining the plasticity itself, the determination of the energy necessary to displace the mass of soil and the particles between them at a fixed speed should be ascertained.

Dr. T. MIECZYNSKI (Pulawy, Poland) assuming that a large quantity of soil for mechanical analysis would be unfavourable to accurate results, while a quantity of 2 gm. would be quite sufficient for a good analysis, pointed only that the soil particles pass through a sieve, of 0.5 mm. has constructed an apparatus for small quantities of soil which allows the separation of particles of less than 0.002 mm. in an ascending current of distilled water and in an average time of 48 hours. Moreover having regard to the importance of establishing the origin of the soil, of the theory of S. ODEN of expressing, the dispersion by continuous measurement of the sedimentation, the author has constructed another apparatus which allows the curves of dispersion to be obtained in a very short time.

Prof. T. BIELER-CHATELAN (Rome), being of opinion that for the purpose of obtaining a truer representation of the actual constitution of the soil *in situ* and to render more comparable the various kinds of analysis, it is advantageous to represent the soil constitution by volume rather than by weight, — referred to some of his own studies on the subject; Prof. A. A. J. von SIGMOND (Budapest), on the basis of his *new experiments on certain physical properties of the soil*, called attention to the importance of the methods of the study of these properties, together with the methods of mechanical analysis. Dr. A. CAUDA (Asti) reported on the "*Influence of chemical reagents on the rapidity of precipitation of clay in suspension*"; Dr. G. GORZ (Berlin) recommended an electrical apparatus for the practical measurement in the field of the water content of the soil, and Dr. Ing. R. TRUKA (Brno) his apparatus for gravimetrical dosage of the finest soil particles. Prof. Ing. A. CLERICI (Rome) suggested for isopicnometric analysis the use of the two bromomercurates of sodium and barium and reported on the results obtained by him with formo-malonate of tallium and with a mixture of formicate and fluoride of tallium respectively for the minerals of specific weight below or above 4.

As regards the properties of clays Dr Novak (Brno) discussed the *composition of colloidal clay*, while Dr S. Johannson (Stockholm) proposed to employ for the testing of viscosity the weight necessary for sinking a conical body in a clay mass. Dr. L. Smollik dealt with various questions connected with the discolloidity of the soil.

Papers were also presented by : Prof. A. Sokoloski (Moscow) on *New methods of physico-mechanical soil analysis and factors in the structure of the soil*; Prof. G. W. Robinson (Bangor) "*On certain regularities in the mechanical composition of soils*"; Dr. J. Zunker (Breslau) on "*The specific surface of the soil*" and by Ing. B. Ramsauer (Salsburg), and Prof. L. Stchussiev (Kischinef).

In the Commission on pedology applied to rural hydraulic work, on the question of soil improvements the following made contributions: Prof. F. Ganssen (Berlin); Dr. Zavadil (Brno), Ing. E. Giovannoni (Rome), Ing. R. Janota (Prague), the latter referring specially to a scheme for the organization of pedological work from the point of view of these improvements. Contributions were also made by Prof. P. Ototsky (Prague) on *The condition of deep spring waters*, by Prof. Olaf Tamm (Alnarp, Sweden) on *Soil silicate*, by Ing. Dei, Pelo Pardi (Rome) who, in discussing *The influence of the excess of moisture in the subsoil on the physical state of the soil* examined the scheme of agricultural hydraulics of the ancient inhabitants of Lazio, by Ing. Byl (Hoofddorp, Holland) who dealt with the subject of *infiltrations in Haarlemmermeerpolder* and finally Dr. Ing. E. G. Dorrell (Prague) who gave an account of the damage done to the dykes by the musk- rat "*Ondatra Zibethicus*".

The Commission for the chemical study of the soil had, as the chief subjects for discussion, three important questions: the exchange of bases, soil acidity and its nutritive substances in relation to the use of fertilizers. As to the first subject, Prof. E. Ramann (Munich) summarized the present position of the question and reported at the same time on the result of his personal experiments which would lead to the following conclusions:

(*a*) neutral salts cause only the change of bases;

(*b*) the hydroxides and salts with alkaline reaction cause the exchange of bases and absorption;

(*c*) acids and salts with acid reaction lead to the decomposition of silicates as well as to the exchange of cations of silicates with the hydrogen of acids, that is to say, to the formation of acid soil. The speaker considered also "buffer action", the degree of soil saturation, and fertilization with lime and marl.

Prof. R. Ganssen (Berlin), I. Hissink (Groningen) and G. Wiegner (Zurich) contributed papers on the exchange of bases and the latter pointed out that clay represents a special case of absorption by an exchange of a chemical dispersoidal character generally observed as "polar".

Two communications were made on *artificial soil*, by S. Herke (Magyaróvár, Hungary) and J. V. Sigmond (Budapest) respectively, and the latter suggested the desirability of finding a simple and rapid method for determining the bases displaced by neutral salt solutions in the soil as well as a method

for the determination of the state of saturation of the soil as the result of the action of these bases.

The subject of soil acidity was discussed in a plenary meeting of the Commissions. A number of papers on the subject were presented: by Dr. Olaf ARRHENIUS (Stockholm) on *The actual and potential acidity of soils*; by Dr. Th. SAIDEL (Bucharest) on *The reaction of the soil in connection not only with vegetation and soil processes, but also with the solutions in the latter*; Dr. R. BRADFIELD (Columbia, Missouri) on *The importance of hydrogen-ion concentration control in physico-chemical studies of heavy soils*, by Professors E. RAMANN (Munich), H. R. CHRISTENSEN (Copehnhagen), AARNIO (Helsingfors), K. ASO (Tokio).

Prof. J. WIVYN (Riga) forwarded a report on *Soil fertility in connection with its acidity*.

For the practical determination of the concentration of hydrogen-ions, Dr. M. TRENEL (Berlin) exhibited his portable electrometrical apparatus, which can be used in field work, Ing. Chim. E. SCHERF (Budapest) a portable apparatus for small quantities of liquid and especially for soil extracts, Dr. P. EMERSON (Ames, Iowa) following the colorimetrical method of BJERRUM, described a method based on coloration produced by the sulpho-cyanide of potassium in the presence of ferric ions; Prof. E. BIMANN (Copenhagen) reported on the determinations which can be made with his chinidronic capillary electrode, Prof. HELBIG and KNICKMANN on *The methods of dosage of acidity applied to tree planted soils*, R. M. BARNETTE, J. HISSINK and J. V. DER SPEK (Groningen) *On certain factors influencing the concentration of hydrogen ions*.

As regards nutritive substances in the soil in connection with the need for fertilizers Prof. MITSCHERLICH (Königsberg, Prussia) considered the problem from a physiological point of view; availing himself of mathematical formulas he has succeeded without making a chemical analysis in determining the fertilizer requirements of a particular soil; Professors K. A. WESTERBERG (Lindingon, Sweden), von SIGMOND (Budapest), HISSINK (Groningen), A. GREGOIRE (Gembloux), R. TRNKA (Brno) gave accounts of observations and experiments on chemical soil analysis, especially with regard to phosphoric acid; Prof. H. HESSELMANN (Stockholm) and Dr. L. SMOLIK (Brno) presented contributions respectively on *Humus in forests of conifers* and on *humus in connection with climate*; Prof. Th. SAIDEL and E. T. PROTOPOPESCU (Bucharest) presented studies of the *Effects upon vegetation of watery solutions of the soil*; W.W. GARNER and J. H. MURTREY (Washington D. C.) *The influence of magnesia*. J. MCHARGUE (Kentucky) *The influence of manganese*; Dr. R. BALLENEGGER (Budapest), V. HOHENSTEIN (Berlin) and Prof. N. GANGULES (Calcutta) reported respectively on Hungarian soils, on the black earth of Germany and on the alkaline soils of India; Prof. C. LUMICO (Rome) and Dr. R. AVATTANEO (Rome), Dr. A. MASSERSCHNUTH and the SOCIETÀ ITALIANA POTASSA (Aachen), dealt with manures especially phosphatic and potassic and finally other papers were given by Prof. H. STREMME (Danzig) on *Soil sanalysis, profiles and colloids*; Dr. D. DICENTY (Budapest) on the *Richness, productivity and fertility of the soils*; Prof. H. HARRASSOWITZ (Giessen) *On the formation of kaolin and "lateritic" soils*; Prof. MCCOOL (Michigan U. S.) on *Soil profiles*; Prof. W. VERNADSKY (Petrograd) on *Rare earth types in the soil*; Prof. P. F. BROWN on *The interpretation of the results of soil experiments*; Ing. J. EGER (Prague) on *The origin*

of alcohol in arable soil; Dr. C. J. Bouyoucos (Michigan U. S.) on *The different forms of water in the soil and their significance*; Prof. R. Lang (Halle) *On the formation of soil earth* and Prof. U. Pratolongo (Milan) on the *Indian alkaline clays*. Prof. J. Wityn (Riga) sent a report on *The principal bases of the process of formation of Podsol.*

Very numerous were the communications made to the two Commissions III (on soil bacteriology and biochemistry) and VI (plant physiology in connection with pedology) which held conjoint meetings. The following presented reports: Dr. H. R. Christensen (Lyngby) on the *Principle of inoculation in field bacteriology*, Dr. N. Weis (Copenhagen) on the *Soil of Danish beech forests*, Prof. G. Lo Priore (Modena) on *The rapid lateritization of a lucerne field*, Prof. E. Pantanelli (Bari) on *The biochemical determination of assimilable phosphate in the soil*, Prof. V. Rivera (Rome) on *The influence of soil conditions in connection with the root development of certain herbaceous plants*, Dr. O. Arrhenius (Stockholm) on *Soil reaction and plant growth*.

Communications were sent to the commissions by Prof. U. Pratolongo, (Milan), F. L. Chodat (Geneva) and H. Niklas (Weihenstephan). As to the more general relations between the soil and vegetation, reports were also presented by Prof. D. Hoagland (California), A. Martelli (Florence) A. Zaharia (Budapest), Dr. J. Dupernoy (Paris) and Dr. K. Maiwald. (Breslau).

Prof. A. Itano (Amherst, Mass.) reported on certain biological studies made by him on peat soils and Prof. S. A. Waksman (New Brunswick U. S.) dealt with soil microbiology and fertilizers in general, and accounts were given of experiments made by himself in conjunction with Prof. J. G. Lipman (New Brunswick) on the oxidation of sulphur in the soil by means of bacteria, in conjunction with Prof. H. Heukelekian (New Brunswick) on cellulose decomposition through soil bacteria, and in conjunction with P. R. L. Starkey (New Brunswick) on the partial sterilization of the soil.

Prof. Perotti (Rome) developed his microorganic theory of fertilization, beginning with the fact that between the mineral and vegetable kingdoms there is a complex and necessary series of phenomena and factors attributable to microorganisms (scale of symbiological reactions). Prof. Perotti also described the results of investigations made by him in collaboration with M. F. Aureli (Rome) on the power of ammonization in agricultural soils, and with M. G. Grandis (Rome) on the method of measuring the power of nitrification in the soil itself. Reports on microbiology in relation to the cycle of nitrogen in nature were presented to the IIIrd Commission by Prof. J. Zolcinsky (Lemberg), P. L. Gainey (Manhattan, Kansas U. S.), E. G. Carter (Utah, U. S.) K. Aso and S. Okhawara (Komaba, Japan) and U. Yamagata (Komaba), K. Asai and U. Murai (Komaba), G. Rossi and Dr. S. Riccardo (Portici), by Dr. A. Bonazzi (Ohio, U. S.) and by Ing. F. C. Geretsen (Groningen). Prof. G. Rossi (Portici) suggested a scheme for an understanding between the field bacteriologists of the world for a systematic study of local agricultural soils and Dr. G. Bergalli Petrucci (Florence) referred to the necessity for coordinating and organizing the microbiological studies of the soil. Prof. J. Stoklasa (Prague) read a paper on *Microbes in connection with soil fertility*, Dr. L. Fetke (Florence) on *The influence of ploughing on soil microorganisms*, Ing. A. Nemec (Prague) on the *Bacteriology of peat [land] soil*, Dr. J. Dufrénoy (Paris) on

Biological soil consolidation, Prof. J. Zolcinski (Lemberg) on *Microorganic factors in the formation of turf and of fossil coal*. Dr. R. Keller and J. Penkava of Prague reported respectively on *Dielectric constants* and on *Radioactivities in the soil*, Dr. R. V. Allison (New Brunswick, U. S.) on *The influence of plant growth on the state of aggregation of soil particles*, and Prof. C. Gorini (Milan) on *The present development of experimental work in pedological microbiology*.

Other reports were presented by Dr. H .Lundegardh on *The formation of carbon dioxide in the soil and its influence on vegetation*; Pr. O. Munerati (Rovigo) on *Experimental technique in relation to variations in substratum*; Prof. E. Pantanelli (Bari) on *Soil physic determined by root excretions*; Prof. J. S. Hargue on *The biological importance of copper, nickel, zinc and cobalt*, Dr. E. Del Villar (Barcellona) on *Soil nomenclature from the point of view of the osmotic pressure of the solutions*, Prof. J. Zolcinsky (Lemberg) on *The action of sunlight in connection with soil genesis and the fertility*, Dr. H. Fischen on *Edaphon a general concept for the biocænosis of the microscopic flora in water and mosses*.

As regards the IVth Commission for soil nomenclature and classification and particularly the European Commission Prof. B. Frosterus the President collected numerous papers which were communicated to the Congress at Rome and published in one volume at Helsingfors at the expense of the Finnish Geological Commission and related to the following countries: Austria, Czecoslovakia, Denmark, Egypt, Finland, France, Germany, Great Britain, Ireland, Norway, Holland, Poland, Rumania, Russia, Sweden, Hungary. These papers may be divided into two principal groups according as the classification is or is not based on the soil profile. In the first group, papers by Prof. B. Aarnio (Helsingfors) and H. Stremme (Dantzig), S. Miklaszewski (Warsaw), G. Murgoci (Bucharest), C. D. Glinka (Petrograd) and Dr. A. Till (Vienna) and P. Enculescu (Bucharest), refer to the nomenclature and classification of soils in general; in those by Prof. H. Stremme (Dantzig), W. Wolff (Berlin), W. F. Hume (Cairo), D. Frosterus (Helsingfors), T. Hallisy (Dublin), K. C. Bjorlikke (Aas), S. Miklaszewski (Warsaw), G. W. Robinson (Bangor), Dr. W. Brenner (Helsingfors), P. Treitz (Budapest), and V. Novak (Brno), the classification is explained by reference to soil formation in limited regions.

To the 2nd group papers were contributed by Ing. Andersen (Copenhagen) and by Drs H. R. Christensen (Lyngby), P. Larne (Gurgy), N. J. Hissink (Groningen), G. Tesch (Haarlem), S. Johansson L. V Post (Stockholm).

Contributions were made to the IVth Commission by Prof. De Angelis d'Ossat (Perugia), who considered the lithological phase of the soil as a characteristic of fundamental inportance for a scientific classification; Prof. F. Todaro (Bologna) who reported on *An economical classification based on the concrete positive data of the productivity of soils*; Prof. R. Trnka (Brno) who reported on *Classification in connection with mechanical analysis and colloidal chemistry*, and Prof. C. J. Marbut (Washington D. C.) who gave an account of *Arid-soils*. The reports by Russian scientists were numerous and included contributions by the following: Glinka, W. Krokos (Odessa), L. Prassoloff (Petrograd), S. S. Neusruev (Petrograd), A. A. Krassuk (Petrograd), A. Kostukiewitch-

Tiesenhausen (Smolensk), G. Mahoff (Kieff); N. Florof (Kischineff), M. Filatov (Moscow), W. W. Hemmerling (Moscow).

The Vth Commission (soil cartography) approved the conclusions of a report by the President, Prof. G. Murgoci (Bucharest) for the production in the shortest time possible of a pedological map of Europe upon the same scale of 1 : 5 000 000 as used in the international pedological map already in existence, and a Permanent Committee was appointed, consisting of Professors D. Prosterus (Helsingfors), K. Glinka (Petrograd), L. Cayeux (Paris) and Dr O. Treitz (Budapest) which will be in entrusted with the collection of the material to be sent by the various countries.

Under the supervision of Prof. Murgoci himself and at the expense of the Rumanian Geological Institute a number of papers by the following authors on cartography in various countries have been published in a single volume. Prof. A. Balloni (Algeria and Tunisia); Prof. G. Murgoci (Anatolia); Dr O. Reis (Bavaria); Prof. A. Grégoire and Fr. Helot (Belgium); Prof J. Kopecky and Dr. J. Spirhanzl (Bohemia); Dr. Novak (Moravia); D J. Andersen (Denmark); Prof. H. Stremme, Prof. W. Wolff, Dr W. Schottler, Dr P. Krische (Germany), G. Stefanini and A. Ferrara (Erithrea and Italian Somaliland); Dr. B. Aarnio (Finland); Prof. M. L. Cayeux, E. Risler (France); Prof. G. W. Robinson (Great Britain); H. Burger (Switzerland); Dr Grenville A. J. Cole (Ireland); Prof. M. Gortani (Italy); Dr. G. Laszlo and O Treitz (Hungary); L. Gentil (Morocco); Prof. J. von Baren (Holland); Dr. K. O. Björlykke (Norway); Prof. V. Leinigenwesterburg and Prof. A Till (Austria); Dr. T. Mieczynski (Poland, Galicia); Prof. H. B. Maufe (Rhodesia); Prof. G. Murgoci (Rumania); Prof. N. Florov (Bessarabia, Ukraine); A. I. Nabokich (Cherson, Russia); Prof. C. J. Marbut, Prof. M. F. Miller, P. E. Brown, R. S. Smith (United States); Prof. H. Hesselmann (Sweden).

Besides the papers, collected in volume form by Prof. Murgoci, others were received by the Vth Commission: — from Dr. A. F. Joseph for the Soudan, Dr, V. M. Mosseri for Egypt, Dr. Jogotaroski for Japan, Mlle Sanders for India, Prof. R. Protopopescu Pake (Bucharest) on the depression in Fiji; Faura I. Sans, for Catalonia, Prof. G. Trabucco (Florence) for the territory of Carmignano and neighbourhood; Prof. G De Angelis d'Ossat (Perugia), on the variety of the criteria employed for field maps; Prof. A. Chevalier (Paris), on the evidence furnished by spontaneous vegetation for soil cartography; Prof. J. Afanacieff (Gorkis, Russia), on a general sketch of the pedological aspect of the globe; Prof O. Marinelli (Florence) for a synoptic table of Italian soils.

On the 5th day of the Congress, a pedological exhibition was opened at the Royal Geological Museum, the exhibits being explained to the members of the Congress by Prof G De Angelis d'Ossat, Eng E. Clerici and Ing. G. Del Pelo Pardi.

Excursion to Latium. — On the 6th day the members made pedological excursions in the neighbourhood of Rome. The various excursions arranged included the following: the Alban hills (volcanic soils), under the guidance of Prof. V. Novarese; Castelporziano (soils and flora of littoral), under the guidance of Prof. R. Pirotti; Fucino (reclamation, drainage of the lake and re-

rious method of utilizing the land) under the guidance of Eng. G. Del Pelo Pardi; and "the Pontine marshes" (turf soils and hydraulic drainage) under the direction of Eng. E. Clerici.

International Society of Pedology. — At the last meeting of the Congress the foundation of the International Society of Soil Science were definitely laid. The object of the Society is to promote the study and progress of pedology by the organization of congresses and meetings, the constitution of special sections and commissions, the publication of a review and the establishment of a Central Office of pedological bibliography at the International Institute of Agriculture. The records of the Society will be kept at the Institute and it will function through an Administrative Office, a Committee and Sub Committees. The Committee in its turn is composed both of the administrative Officials and of a number of members elected by the Congress and of representatives of the Sections for special study which may be formed for different countries, and also of representatives of the Sub Committees, elected by the Congress or by the Committee itself for the study of particular branches of pedology.

A General Congress must be summoned at least every 5 years by the Administrative Office after arrangement with the International Institute of Agriculture. This Congress in addition to its scientific work will have the general administrative control of the Society and will elect the office-bearers.

The Review, which will be published by the administrative Office will be in the first place a scientific journal for the publication of original work in the various branches of pedology, but will also contain a regular series of special reviews and also reviews in five languages, English, Italian, French, Spanish, German, of the more important recent publications and general information concerning the Association.

In the meantime the following were elected to offices in connection with the Society: Presidents, Dr. J. G. Lipman (New Brunswick) and Dr. D. J. Hissink (Groningen); Vice-Presidents, Prof. Dr. G. De Angelis d'Ossat (Rome) and Prof. B. Frosterus (Helsingfors); General Secretary, Dr. D. J. Hissink; Editor of the Review, Prof. Dr. F. Schucht (Berlin); Librarian, Dr. G. Borghesani (Rome); Members of the Consultative Committee: Professors André (Paris), Aso (Tokio), H. Christensen (Copenhagen), H. Hesselmann (Stockholm), Miklaszewsky (Warsaw), Novarese (Rome); Chairmen of the Sub-Committees I. Dr. Novak (Brno); II. Pr. Prof. A. Von Sigmond (Budapest); III. Prof. Dr. J. Stoklasa (Prague); IV. Prof. Dr. E. A. Mitscherlich (Königsberg); V. Prof. Marbut (Washington); VI. Ing. Girsberger (Zurich).

Closing Meetings. — The closing meetings of the Congress took place at the Ministry of National Economy in the presence of His Excellency, Signor Serpieri, and on the conclusion of the special business of the Congress speeches of thanks, greetings and good wishes were made by Prof. De Angelis d'Ossat and many delegates, while finally the Minister the Hon. Signor Corbino conveyed a message of welcome from the Government to the members of the Congress.

On May 21 an excursion was made by the members to Naples and neighbourhood. Visits were paid to the Royal School of Agriculture at Portici, and Gussone park where excavations and sections of soil had been prepared for the purpose of giving the members of the Congress present a clear idea of the Vesuvian

soils and their characteristics, especially in connection with the last eruption in 1915. Finally, under the guidance of Prof. A. MAILARDO, Director of the Observatory, an ascent on Vesuvius was made.

The publication of the reports of this most important Conference has been undertaken by the International Institute ofAgriculture. In addition to official matter, the reports will include the deliberations of the six Commissions, the rules approved for experimental work in the various branches of pedology, papers and communications (over 200 in number) in the original text in the language of the various authors, accompanied by a summary in French or English, as well as by numerous illustrations, diagrams and maps.

In this way this memorable scientific Congress was brought to a close. The International Institute of Agriculture, under whose auspices the organization of the Congress was carried out, will henceforth become the centre for the development and co-ordination of the researches, experiments, and observations, which may be effected in connection with the various branches of pedology in various Countries. A beginning has thus been made with the work of bringing uniformity and fixed standards into the agricultural sciences and this uniformity in the methods and criteria of study and research, will, as has been the case in other branches of knowledge, bring about fruitful results and in practice a close collaboration, based on general directing principles accepted by all scientists in the different nations.

The Institute has already made its influence felt in connection with the Congress which led to the conclusion of the International Convention on Plant Diseases, the establishment of the Commission of Agricultural Meteorology and the Madrid Conference on the olive fly.

Moreover, the *International Association for Seed Control* has entered into an arrangement with the Institute, whereby the Bureau of Agricultural Science will be employed as its publishing and co-ordinating organ, and, according to the conference at Cambridge, the Meeting of the International Seed Testing Conference will also take place at the Institute.

The same applies to the general co-ordinating work of the Institute in regard to the activities of the experimental stations of Forestry, of the International Commission for Fertilizer analyses and also to the International Conference on Olive Cultivation which will meet at the Institute; to field mechanics and to the practical problems of plant and animal genetics, etc. In this way the International Institute of Agriculture will in time become the centre of all world agricultural activities both theoretical and practical, which it will co-ordinate and whose results it will make fruitful by assuring their continuity both in space and time which is such a necessary condition of success.

791. **VII International Congress of Olive-culture, Seville, Dec. 5-19 1924,** — The Congress will have five sections:— (1) The best methods of cultivation (fertilizers and protection of the young trees, pruning and clearing; harvesting; transport and preservation of the drupes; (2) Industrial questions (oil manufacture, utilization of residues, preparation for market; (3) Trade questions (internal trade, foreign trade, statistics of production and consumption, importation and exportation in the different countries, trade marks, certificates of origin); (4) Olive pests (the most important diseases

and methods of prevention and control); (5) Condition of purity in the oil (refining, purification, mixing and methods of analysis).

In connection with the Congress an award of three prizes will be made, each of the value of 5000 pesetas, for the best reports, dealing with the three following subjects:

(1) The elimination of the bitter element in olive-oil without detriment to its quality.

(2) The combination of olive-oil with other inodorous oils.

(3) The adaptation of the methods of utilizing olive residues to small farms.

Further particulars may be obtained from the « Oficinas centrales del VII Congreso Internacional de Oleicultura, Palacio del Senado, Madrid ».

792. **Canada: Third World Congress and Exhibition of Poultry Farming Ottawa, 1927.**

793. **Fourth International Congress of Refrigeration, Rome 1927.**

794. **The Congress of the " Association française pour l'avancement des Sciences ", Liège 28th July-2nd August 1924.** — The following is the programme of the Agricultural Section presided over by M. C. JOURNÉE of the " Institut agronomique " at Gembloux: (1) Soil composition in hot and dry regions. — (2) Utilization of the small strips of land along the coast by means of the elimination of salt and irrigation. — (3) Mathematical expression of the influence of fertilizing elements contained or introduced into the soil. — (4) Potash: its function in the development of vines and in the quantity and quality of the grape. — (5) Function of potash in the constitution of vines. — (6) Utilization of barren and uncultivated lands by the cultivation of resinous plants and plants for perfumes. — (7) Means of crop improvement. — (8) Selection of cereal types adapted to soils and climate. — (9) Diseases causing degeneration of the potato. — (10) The *Doryphora* of the potato. — (11) New types or grafts. — (12) Treatment of vine mildew. — (13) Co-operation in wine making; co-operative canteens. — (14) Rational scientific feeding of domestic animals. — (14-*a*) Application of mendelism to the improvement of domestic animals. — (15) The hygiene of African flocks of sheep and of migrating flocks. — (16) Microbes and the disinfection of land. — (17) Catalysing fertilizers. — (18) Products of the sea pine. — (19) Diseases of chestnuts. — (20) Control of fungus diseases.

For information apply to the offices of the Association, 28 Rue Serpente, Paris.

795. **Congress of the Municipalities of the State of Minas Geraes, Brazil.** — A report has been published in the volume *Annaes do Congresso das Municipalidades Mineiras reunido em Bello Horizonte de* 3 *a* 10 *de Junho de* 1923, pp. 659. Bello Horizonte, Imprensa Official, 1924. A great part of the work of the Congress was devoted to the discussion and formulation of the best methods by which Municipal Authorities could participate in agricultural progress; propaganda for the diffusion of forage and hay cultivation; stations for the improvement of live stock and stud service; veterinary police; control of plant diseases, etc.

796. **Congress of French Agriculture, Toulouse, 12-13 June 1924.** — This was the sixth national annual congress organised by the "Confédération Nationale des Associations agricoles, 39 Rue d'Amsterdam, Paris, IX.

797. **Congress of Apiculture, Paris 5-6 May 1924, organized by the Paris-Orleans Railway Company.** — The following are some of the resolutions of the Congress: — That the attention of the Governor General of North Africa and of the French colonies be drawn to the importance of intensifying the production of beeswax which would certainly find a good market in France. That the measures adopted by the Government in favour of the intensification and development of apiculture and honey should continue to operate. That the scientific laboratories, especially those of the Institut Agronomique and of the Institut Pasteur, should at once initiate a special study of swarm diseases and that official measures should be adopted to prevent the spread of these diseases and particularly that of brood disease.

798. **First Congress for the supply of electric power to country districts, Lyons, October 1924.** — The "Federation Nationale française des collectivités d'électrification rurale" has decided to hold this congress in the second fortnight of October.

The agenda includes the examination of some 30 reports upon all questions relating supply of electric power to rural areas. The reports will be considered in connection with demonstrations of electric supply methods, lasting for 15 days, at an agricultural exhibition included in the programme of the Lyons Exhibition. For information apply to the "Fédération Nationale des collectivités d'électrification rurale, 5, Avenue de l'Opéra, Paris I".

799. **A week of intensive horticulture** organized by the commercial services of the Paris-Orleans Railway company in co-operation with the Agricultural Institute of Loire-Inférieure and various agricultural associations, took place from the 22nd to the 28th June at Nantes, on the occasion of the Exhibition in that city. For information apply to: M. POHER, Ingénieur des Services Commerciaux P. O. 1 Place Valhubert, Paris.

800. **French North African Conference. Rabat 7-9 April 1924.** — This Conference was held like its precedecessor, of which a report was published in the number of the 8th February 1923 of the *Cahiers coloniaux de l'Institut colonial de Marseille*, between the Governor General of Algeria and the Residents General of Tunis and Morocco. The object in both cases was the co-ordination of the Services of the three colonies. At the second conference the questions considered included sanitation, an agreement between the fiscal administrations for the suppression of smuggling, questions concerning public works, road connections, combustibles, surveying utilization of the Plain of Baharia, agricultural questions (unification of forest legislation and of the methods of forestry in North Africa, sanitary police for plants at the Algerian-Morocco frontier, etc.) — Membership of organizations of a scientific-historical character and for propaganda. — Research and scientific relations (linking up of meteorological services, etc.). (*Les cahiers coloniaux de l'Institut Colonial de Marseille*, No. 280, 1924).

801. **Rumanian Agricultural Congress (Bucharest 4-6 February 1924)** organised by the society of Rumanian farmers. Among the questions considered by the congress were: — The organization of the various categor-

ies of producers for common purposes; legal regulations for agricultural development issued after the year 1918; the production and distribution of selected seeds; the organisation of the trade in cereals, garden produce and fruit; improvement in stock rearing; organization of farmers for the purpose of utilizing uncultivated lands. (*Correspondance économique roumaine, Bulletin Officiel du Ministère de l'Industrie et du Commerce, Royaume de Roumanie*, Year V, No. 1, pp. 87-90. Bucharest 1924).

Exhibitions, Fairs and Competitions.

802. **France. Nineteenth Motor Exhibition, Paris, Grand Palais, 2-31 October 1924.**

803. **Autumn Sample Fair — Lyons — 21 Oct.-20 Nov. 1924.**

804. **Great Britain. Egg laying competition for Gloucester county, England.** — The competition started on the 7th October 1922. Each hen was allowed 0.36 square metres of coop space and 2.16 square metres of open ground as a run. In the first year there were 52 poultry pens with 250 hens. The mortality was 1 %. The total number of eggs laid amounted to 50 978, or an average of 196 per hen. The group giving the maximum of production showed 240 eggs per hen; the best hen (Wyandotte white) laid 301 eggs in 48 weeks.

The duck egg laying competition began on the 3rd November 1922 and 11 groups each consisting of 4 ducks were entered. The best group made a showing of an average of 175.5 eggs per duck in 48 weeks. (*Journal d'Agriculture pratique*, Year 88, Vol. 1, No. 2, p. 482. Paris, 1924).

805. **Italy. International Exhibition for Phylloxera Control and Vineyard Reconstruction. Casalmonferrato 10th August-15th September 1924.** — The programme includes 4 divisions The phylloxera and the losses caused by phylloxera — Antiphylloxera remedies — American vines — Vineyard reconstruction. For information apply to A. MARESCALCHI, Casal Monferrato.

806. **National Fruit Show, Trent, 20-30 Sept. 1924.** — For information apply to Giulio Catoni, President of the Agricultural Council of Trento, Italy.

807. **National Exhibition of pure chemistry and chemistry as applied to industry, Turin, September-October 1924.** — This exhibition includes among others the following groups: Chemical fertilizers; Industries relating to food products; The sugar trade; Agricultural industries; The trade aspect of organic and inorganic chemistry; Industry as concerned with fermentation and distillation; Treatment of textile fibres; Machinery and accessories employed in the chemical and chemico-agricultural industries; Industries concerned with refrigeration; Various trades. For information apply to the office of the organizing committee, Turin, Via Garibaldi, 35.

808. **Luxemburg. Third Commercial Fair. Luxemburg, 20-28 August 1924.** — For information apply to the Comité de la Foire, 19, Rue des Bains, Luxemburg.

809. **Italian sample Exhibition in Christiania, Norway, September-October 1924.** — This exhibition has been organized under the auspices and the control of the Italian Royal Legation. One section is devoted to agri-

cultural and food industries (preserved food, rice, vegetables, fruit, liqueurs, tomato and similar preserves, cheeses, oil, wine, biscuits, peas, beans and other legumes, forage, etc.). For information apply to Cav. R. LUZI, Commercial attaché, Legazione d'Italia, Christiania.

810. **New Zealand. Dunedin International Exhibition, November 1924.** — For information apply to the High Commissioner for New Zealand, 413-15 Strand, London W. C. 2.

Miscellaneous.

811. **Argentina. The work of the Government for the development of foreign markets for meat.** — The Argentine Government has inaugurated a world wide publicity campaign for the purpose of increasing the Argentine exports of meat. The failure of several plans to relieve the depression in the Argentine meat industry during the past two years has convinced the Government that the only remedy lies, not in an attempt to bolster or stabilize the price through legislation, but rather in increasing the demand and leaving the price to adjust itself according to the law of supply and demand.

The Argentine Ministry of Agriculture has announced that the campaign would be started through the Argentine Chamber of Commerce, the Argentine Consular and Diplomatic service and special corporations interested in developing the meat trade. It has been decided that no appeal would be made directly to the public until further plans have been made and advertisements prepared that would be adaptable to the people for whom they were intended. Motion picture films depicting the cattle-raising industry of the Argentine, have been prepared for distribution in France, Spain, Germany and Italy. In addition, the department has a large pamphlet ready for distribution entitled " Meats and Meat Production in the Argentine ". (*Crops and Markets*, Washington, D. C., Vol. I, No. 18, 1924).

812. **Agriculture in Brazil.** — The following data have been taken from the 1924 Message of the President of the Republic, His Excellency Arthur DA SILVA BERNARDES (Mensagem apresentada ao Congresso Nacional na abertura da primeira Secção da decimasegunda legislatura pelo Presidente da Republica Arthur da Silva Bernardes, 1924. *Diario Official, Estados Unidos do Brasil*, Year LXIII, No. 108, pp. 11387-11481, Rio de Janeiro, 4th May, 1924).

Land improvements : hydraulic works and provision of drinking water. — In the North-East of Brazil great irrigation works are being carried out, under the direction of the " Inspectoria Federal de Obras contra as seccas ". In Ceará great barrage dikes are being constructed for the formation of artificial lakes at Poco dos Paus, Oros, Patu, Quixeramobim and Arcarape. The second and the last are almost completed. In Paralyiba the great dams of São Gonçalo, Piranhas and Pilões are under construction ; in Rio Grande do Norte those of Gargalheira and Parelhas. In 1923, in the North Eastern states, the construction of numerous locks were completed, including that of Malhada Vermelha, on the Rio Grande do Norte, having a capacity of 7.5 million cubic metres, as well as 70 tubular wells for the provision of water for domestic use and the watering of cattle. Schemes for the utilisation of the waters of the rivers São Pedro, Mantiqueira, Matto Grosso, xérem, Mazomba for distribution in inhabited centres are also under consideration.

The Ministry of Agriculture had, for the year 1923, a budget of 468 700 gold milreis, that is 86 000 more than in the preceding year. This constitutes 4 % of the total budget of the Republic.

Information in regard to crops is obtained by means of questionnaires sent by the " Serviço de Inspecção e Fomento agricola " to every municipal authority asking for figures for their principal crops and also through enquiries made directly and on the spot. The yields for the agricultural year 1922-23 thus ascertained were as follows (in round numbers): picked cotton 119 000 tons, rice 859 000 tons, sugar of all kinds 761 000 tons (1), lucern 216 000 tons, potatoes 208 000 tons, rubber 196 000 tons, cocoa 52 000 tons, coffee, 1 140 tons, " abassù " fruits (*Orbignia martiana*) 45 000 tons, other oil producing palm fruits 86 557 000 fruits, manioc flour 658 000 tons, beans 630 000 tons, matè 193 000 tons, maize 5 136 500 tons, tobacco 70 900 tons, wheat 80 200 tons, wine 442,400 hl., brandy 1 491 000 hl.

The " Serviço de Inspecção e Fomento Agricola " in 1923 distributed to farmers 371 847 kilos of selected seeds and also 23 100 fruit grafts. It has five stations for seed production: Espirito Santo (Parahyba), Rezende (Rio de Janeiro), Lorena and São Simão (San Paolo), Itajahy (Santa Catharina). At 145 stations, in co-operation with the farmers, provision is made for demonstrations of the best methods of cultivation. An active propaganda for agricultural co-operation is being carried out. In addition, the Government gives special encouragement to the national trade in fertilizers in which national raw material is used, and 39 021 tons of manure were produced in 1923.

Crops: Coffee is the most important of the agricultural products of Brazil both financially and otherwise.

The cultivation of cotton under the Federal Government and the Governments of the individual States, is making constant and rapid progress: the exportation of raw cotton rose from 2 600 tons in 1922 to 34 000 tons in 1923.

By a decree No. 16122 of the 12th August 1923 the " Serviço do Algodão " has been organised of which the object is the progress and supervision of the cotton crops and the control of its parasites and pests: by a decree No. 15900 of the 20th December 1922 measures were taken for the suppression of fraudulent practices in the cotton trade. There is a " Serviço de Classificação do Algodão " and the Commercial Exchange of San Paolo has founded a school for the classification of cotton. In collaboration with the " Instituto Biologico de Defensa Agricola " the " Serviço do Algodão " has organised the control of the pink-boll-worm (*Platyedra gossypiella*) (2) and established methods for the purification of seeds, and measures have been taken against the introduction of substitutes. (It is forbidden throughout all

(1) According to information furnished by the Brazilian Ministry of Agriculture, the production of sugar in 1923-24 throughout the country was 644 410 tons, so that Brazil holds the fourth place in world sugar production, coming after Cuba, India and Java. Internal consumption is about 250 000 tons per year. In the first 8 months of 1923, 105 029 tons were exported. (*Tropical Agriculture, the Journal of the Imperial College of Tropical Agriculture*, Vol. I, No. 5, p. 64. Trinidad, 1924).

(2) See *R.* 1921, No. 1306. (*Ed.*)

the States, to introduce unginned cotton; in Rio de Janeiro there is a plant for cotton disinfection by means of hydrocyanic acid, constructed by the firm of J. P. Devine & Co., Buffalo U. S.).

In 1923 the Cotton Service distributed 302 tons of good seeds and the equipment of two experimental sections for cotton one at Piracicaba and the other at Seridó, is being completed, while the plantations for selected seed production at Pendencia, Coroatá and Igarapé-Assu have been enlarged.

For the year 1923-1924 a production of 150 000 tons of ginned cotton from 795 532 hectares is expected, that is, 30 % above that of the previous year. The first place in production (about a quarter of the whole) belongs to the State of S. Paolo, followed in order by Ceará, Parahyba, Pernambuco, Rio Grande do Norte, etc.

The conditions of the Rubber industry improved very considerably in 1923 following on the stabilization of prices, as fixed by the planters. The Government asked the National Congress for funds to subsidize this important industry especially for the formation of regular plantations so as to obtain more readily more profitable returns.

The cultivation of the sugar cane is undergoing a period of revival. One of the chief causes militating against progress is the degeneration of the varieties grown in the different districts and this it is hoped to eliminate by means of selective experiments at different stations.

Rice cultivation is also making rapid progress, especially in the State of San Paolo, which produced 364 000 tons of rice in 1923, followed by the State of Rio Grande do Sul with 174 000 tons, and of Minas Geraes with 128 000 tons.

The State of Bahia, is the chief centre for the production of cacao. The most serious obstacle against further development is a lack of the quality of resistance.

The cultivation of wheat is encouraged by the Government by means of the distribution of specially selected seeds and propaganda for the most extensive sowing. The crop is, however, limited to the States in the extreme south (1).

Fruit growing is making good progress and has received Government encouragement in various forms. The export of Brazilian oranges has had good results and oranges to the value of 5 646 000 *milreis* were exported in 1923 mainly to the United States, where they arrived at a period when the native product is scarce.

(1) The marked increase in the production of wheat, oats, rye and barley during the year 1923-24 in the States of Parana, Santa Catharina and Rio Grande (the only States in Brazil where these cereals are cultivated) is due according to the "Directoria de Fomento" not only to the favourable season but also to the use of specially chosen seeds, selected at the experiment stations in Brazil or introduced from Uruguay and [illegible] (*Boletim Ferro Carril*, Nos. 429 and 430, Rio de Janeiro, 1924). The "Estação Experimental de Diego Alfredo Chaves" of Rio Grande do Sul has provided the "Inspectoria Agricola" of Porto Alegre, for agricultural year 1923-24 with 70 quintals of wheat seeds and 15 quintals of barley seeds for the growing of various qualities and kinds selected at the Station (Bulletin, No. 341). (*Ed.*)

Tobacco is mainly grown in the State of Bahia with an average annual yield of 27 200 tons, followed by Rio Grande do Sul (average yield 19 400 tons), Minas Geraes (yield 8 000 tons in 1923) and Parà (yield 3 000 tons in 1923).

The cultivation of the vine and wine making are in continual progress especially in the States of San Paolo and the southern part of Minas Geraes; for the further development of this industry two experimental stations have been set up, and the station at Caxias has largely contributed to the improvement of wine production in the State of Rio Grande do Sul.

An enquiry has been made into the industry and trade in timber (1).

A considerable part of the activity of the " Jardim Botanico " of Rio de Janeiro, is devoted to questions of forestry and the work of acclimatizing various exotic species has been particularly successful. The Botanical Garden has a special service for the exchange of seeds and plants and in 1923 about 70. 000 plants were distributed. In the " Reserva Florestal " of Itatiaya the practical application of plant biology receives special consideration.

Stock-raising Industry. — This industry in Brazil, as in the Argentine, experienced a grave crisis on the termination of the European war. The low rate of the Brazilian exchange allowed about 200 000 tons of animal products to be exported in 1923. In that year the exportation of frozen Brazilian meat to England was organized, and has been very successful. Oxen for improvement purposes were also exported to Mexico. The selection of the Caracu breed in the state of San Paolo (2) has been followed up and crossings of the native oxen with the race " limousine " have been made in order to increase the production of milk. The above in conjunction with the inauguration of an industry for milk products is one of the measures, taken by the Government to encourage national stock-breeding (2). The planting of lucern fields has been successfully carried out especially in the States of San Paolo and Rio Grande do Sul and their rapid diffusion is a safe guarantee of progress in stock raising. Important studies in regard to native forage have been carried out by the " Estaçao de Agrostologia " of the Ministry of Agriculture.

Silk Cultivation. By the law No. 4632 of the 6th January 1923 special privileges were granted to the three largest silk-worm breeding companies in Brazil. As a result of this law the " Sociedade industrias de Seda Nacional " has been formed with its offices in Campinas, which has founded an " Instituto de Sericoltura ", established large plantations of mulberry trees and largely developed silk worm rearing in San Paolo and the neighbouring districts. The " Estação Sericola " in Barbacena is a government station and is enquiring into the actual conditions of sericulture in the States of Minas Geraes, Rio de Janeiro, Santa Catharina and Rio Grande do Sul.

Agricultural Industries. The attention of the Government has been recently devolved to the encouragement of various industries for the manufacture of agricultural products; pão-mixto (bread made of a mixture of

(1) See *R.* 1924, No. 113. (*Ed.*)

(2) See No. 684 of this *Review.* (*Ed.*)

wheat and manioc flour), alcohol (using an improved quality of ferment so as to double the output), Rubber factories, etc.

Control of Crop Parasites and Pests. — The Biological Institute of Agricultural Protection, founded in 1920, is continuing its work. The "Serviço de Phytopathologia" of the Institute in 1923 carried out enquiries as to the diseases of 42 cultivated crops and more particularly the infection of the orange trees caused by the *Cladosporium citri*. The "Serviço de Entomologia Agricola" published five pamphlets and studied 95 species of noxious insects and the most effective insecticides for their control. The "Serviço de Vigilancia Vegetal", which carries out the inspection of all vegetable products imported into Brazil discovered at the port of Rio de Janeiro 5 species of injurious insects which had not hitherto been reported in the country. This service is carried on at the following ports: Recife, Bahia, Rio de Janeiro, Santos, Rio Grande, and has been extended to the port of San Francisco (State of Santa Catharina).

The Biological Institute includes the following: the Experimental and Demonstration Station of Deodoro, the Service for the Selection of Immune or Resistant Plants, and the Laboratory for Soil Microbiology.

Brazil, in agreement with other States, is organizing a systematic effort to get rid of the white ant which is the greatest bane of Brazilian agriculture, by the destruction of the ant-hills and is also establising a special corps of itinerant instructors for giving information on the farm themselves as to the methods of using insecticides and fungicides.

The Supreme Council of Agricultural Protection has taken important steps to prevent the introduction of new pests into the country and to bring about a more efficient collaboration of the Ministerial services in the control of the spread of insects and parasites which are injurious to the crops. There is a Service for cleansing and selecting cereals, and the necessity for making compulsory the the cleansing of cereals and the introduction of uniform methods of classification has been established clearly demonstrated (TORRES)

The following information is taken from the speech of Doct. Athur TORRES FILHO on the occasion of the close of the Session and the examination for the Diploma of 1923 at the Agricultural School of Piracicaba, San Paolo (Discurso do Paranympho Dr. Arthur TORRES FILHO, nas festas de formatura dos agronomos de 1923, da Escola Agricola "Luiz de Queiroz", em Piracicaba *Revista Agricola, industrial e commercial Mineira*, Vol II, No. 2, pp. 80-94. Bello Horizonte, 1924).

According to the census of 1920 made by the "Directorio General de Estadisticas" of the Ministry of Agriculture — the value of Brazilian agricultural production in 1920 amounted in round figures to 21 146 000 000 milreis, divided as follows: value of the soil, of machinery and tools, 10 568 milreis; value of stock, 6 184 millions; value of agricultural, products, 4 394 millions. The number of farms was 648,153, covering an area of 173 104 678 hectares, and over 73 % of these farms were managed directly by the owners.

In 1921 the value of the exported crop products of Brazil amounted to 80.3 % of the total exports, and in bulk to 70 %. cattle representing 10.8 % in value and 7.2 % in bulk.

Coffee, cotton, wool, sugar, cocoa, rubber, tobacco, maté, tea, Copernicia

cerifera, oil fruits, manioc flour, beans etc. are the principal exported vegetable products in order of importance.

According to the account given by J. Bartosa, (*Revista agricola, industrial e commercial Mineira*, Vol. II, No. 2, pp. 73-75, Bello Horizonte, 1924) the export of oil fruits from Brazil which a few years ago was insignificant, is making a continual and rapid progress and reached 100 000 tons in 1922 and 1923, while the price is also rapidly growing. The supplies are provided by a great number of wild plants of various species and cultivation would be highly advantageous in bringing about a marked increase in production.

813. **Exploitation in the Amazon Valley.** — Dr. Charles LA RUE of the faculty of Botany, at Michigan University, United States, finished in March 1924 his 8 months exploration in various parts of the Valley of the Amazon (Brazil and Bolivia) where, as a specialist for rubber cultivation, he made a study of this industry for the Ministry of Agriculture. The objects of the expedition were as follows : (1) the study of the present condition of the rubber industry in Brazil, including the area covered by the wild rubber plant and the different systems of production ; (2) the study of the species of trees especially those growing on the lower reaches of the Amazon river the rubber trees in the East, which to-day give most of the rubber output in the Malay States, India, Borneo, Ceylon, Java and Sumatra, were all originally transplanted from Brazil ; (3) physiological studies of the rubber tree and general botanical studies ; (4) the diseases of the rubber tree, Dr. J. B. WEIR (pathologist of the Bureau of the Plant Industry of the Ministry of Agriculture, of the United States of America, was in charge of these studies) ; (5) studies of the conditions and methods of production in the district of Acre (Higher Amazon River) which produces the best quality of rubber.

The results of the expedition will be published in Dr. LA RUE'S Report to the Ministry of Agriculture.

814. **Irrigation Scheme in India.** — A great irrigation scheme has been planned in Southern India which involves the storage of 80 000 000 cubic feet of water, from the Cauvery River, to be used for the irrigation of 300 000 acres. (*Science*, No. 1532 p. XIV, New York, 1924).

815. **Agricultural progress in Palestine** is described in the *Commercial Bulletin* of the Director of Agriculture. There are three distinct types of agriculture ; grazing of camels, sheep, goats and horses, as practised by the Bedouin tribes farming as carried out by the native Arabs, and the activities of the colonies of agricultural immigrants in all parts of the country who have introduced the latest western methods of agriculture. The immigrants are as a rule of German or Jewish origin, the latter being affiliated to the Jewish Colonisation Association or the Palestine Zionist Executive. Progress is marked by the improved breeds of milch cattle, the development of poultry rearing and apiculture, the use of chemical fertilisers and selected seeds and also by the introduction of new and more profitable crops, such as tobacco, potatoes, flax, beet, sugar cane, etc... (*The Board of Trade Journal*, No. 1437, London, 1924).

816. **Agriculture and Trade in the Cape Verde Islands in 1923.** — The island of Cape Verde, which, owing to its geographical position, is a very important coaling and oil fuel station, is almost barren, owing chiefly to lack of water ;

though the other islands of the archipelago, where the inhabitants derive their means of subsistence almost exclusively from agriculture, produce a variety of crops, of which the most important are maize (the principal article of food among the natives), pulgheira seed, sugar cane (from which raw sugar and spirit or " aguardente " are made), coffee of excellent quality and various kinds of fruits, notably oranges and bananas. The methods of agriculture among the natives are of a very primitive kind ; in effect the only implement is the spade and it is very doubtful whether the introduction of modern methods would result in great improvements, either in the quality or the quantity of the crops. An experimental agricultural and cattle raising station has been established at Praia but the results, so far, appear to be small. Fish of all kinds and of excellent quality abound throughout the archipelago, and form one of the main foods of the people. Salt is, or has been, produced in considerable quantities in the Sal, Mayo and Boa Vista islands. The island of Fogo contains valuable deposits of sulphur of exceptional purity in addition to sulphate of soda but these are at present almost unworked.

According to the Trade Statistics for the Cape Verde Islands, the total value of imports in 1923 was 43 510 716 escudos as compared with 30,002,924 in 1922. The principal articles imported, apart from coal and fuel oil, are maize, flour, tapioca, sugar, rice, olive oil, fat, alcoholic beverages, tinned foods, etc. Exports during 1923 were valued at 395,604 esc., as compared with 680,035 esc. in the previous year, the principal commodities exported being pulgheira seed, coffee, skins, and salt. (*The Board of Trade Journal*, No. 1431. **London, 1924**).

817. **Silk growing in Syria** shows great possibilities of development and has already made considerable progress, the production of cocoons having doubled in 1924. The irrigation works proposed by the High Commissioner will bring about still further progress in this industry. The measures taken by the High Commissioner in conjunction with the Chamber of Commerce of Lyons, deal chiefly with the replanting of mulberry trees, and the improvement of the production of the silkworm eggs. A " Bureau " of Silk-Culture will be organised at Beirut in co-operation with the Chamber of Commerce. (*Revue bimensuelle de la sériciculture*, No. 10, 1924).

818. **Large agricultural area opened in South Africa.** — One of the largest land settlement and irrigation schemes ever proposed in South Africa is nearing completion at Graaff Reinet. The scheme will open up an area of 105 000 acres, which is to be devoted to the dairy industry, pig breeding, poultry keeping and fruit growing. The land is to be subdivided and sold to settlers in small parcels of 30 acres. A central training farm staffed by agricultural experts will be maintained to assist settlers in the profitable farming of the land. The district is near Port Elizabeth and is intersected by the Elizabeth-Rozmead railroad. (*Crops and Markets*, Vol. I, No 17, Washington, 1924).

819. **Herd-Book of Dutch Cattle in the State of San Paolo, Brazil.** — As a result of the efforts of the chief cattle-breeders a " Herd-Book Hollandez de São Paulo " is being compiled by the " Liga agricola brazileira ", São Paulo, rua L. Bento, n. 10. (*Boletim-Ferro-Carril*, Series XV, **Vol. XXVI, No. 345, p. 524. Rio de Janeiro, 1924**).

820. **Consuls of the United States to co-operate with the Department of Agriculture.** — Agreements have recently been made by the U. S. Department of Agriculture with the Department of State for the periodic preparation of weekly, monthly, and annual reports by members of the Consular Service in the important producing and consuming countries on all of the important agricultural staples. This information will be published regularly in *Foreign Crops and Markets*. (*Crops and Markets*, Vol. I, No. 13, 1924).

821. **Cheese-Grading Facilities in Finland.** — The Government of Finland has organised at Helsingfors a Bureau for the inpection of cheese intended for export. Dairies in Finland have been invited to make use of this Bureau in order to enhance the prestige of Finnish cheese in the foreign markets. Dairies desiring to utilise this service must inform the Bureau of their production methods, grant free access to their books and must allow the Government to inspect their factories. Such dairies will receive registration numbers, which numbers are to be used as marks of origin. The actual inspection of cheese will include a chemical analysis and the rendering of a quality classification by the Government.

Exports of cheese from Finland during 1923 amounted to only 3 000 000 lbs. as compared with nearly 6 000 000 in 1922. (*Crops and Markets*, Vol. I, No. 16. Washington, 1924).

822. **National Federation of rural electrical enterprises in France.** Head Office : 5 Avenue de l'Opéra, Paris. — This organisation includes, among its objects, that of bringing electricity undertakings in country district into closer touch, for the protection of their common interests and the organisation of new centres or groups : it approaches public bodies, when necessary, and also firms which produce and distribute electrical current, contractors, engineers and consumers for the purpose of encouraging and developing nationally the work of electrification. The Federation also keeps complete records of the actual condition of electrical enterprise in the different countries, making a particular study of rural wiring systems and the use of electric current in the country. (*La Vie agricole et rurale*, No. 15, 1924).

823. **National Association of French Wheat-Growers.** — This Association is in process of formation. Its chief purpose will be to being the professional associations and the individual farmer into touch, for the protection of their common interests, both economic and agricultural. The Association will deal more particularly with the following questions :

(1) The establishment of fair prices for grain and straw, and the coordination of the activities of all the affiliated bodies to this end.

(2) The collection and publication of information relating to the condition of crops and the state of the markets.

(3) The development of exchange of goods between the different districts as well as foreign countries.

(4) The study of the cost of wheat production and the normal relation between the prices of wheat, flour and bread.

(5) The study of all agricultural processes likely to improve and increase production.

(6) The development of Mutual Credit Societies, and Unions of wheat-growers in France and French North Africa.

824. **Italy. National Scientific and Technical Committee.** — At a Meeting held on May 31, 1924 in the hall of the Industrial Association of Italy at the Polytechnic at Milan, Signor Ing. G. SEMENZA, President of the National Scientific and Technical Committee, in collaboration with the Secretary, Prof. COTTAFAVRO, presented a report on the work of the year 1923, showing the action taken by the Committee on behalf of the university science laboratories by the supply of apparatus, collection of funds, etc. He also reported that a scheme for the formation of a large central institute of research had been under consideration, and invited those present to support the Bibliographical Section of the *Technical and Scientific Archives*, the object of which is to put at the disposal of business men, students and technical experts all records and information which may be necessary and useful in the different departments of their work. Reference was made to the formation of a Committee for the consideration of new inventions, which may in time be able to give assistance to inventors, of a scientific, technical and financial character.

825. **Technical methods adopted for the development of agriculture in Norway.** — The amount of territory under cultivation in Norway is in round figures 735 000 hectares (exclusive of woods, arable land, etc.). Most of the properties are small, since 90 % are of less than 10 hectares, although each cultivated and meadow area will have a certain area of wood and pasture land in addition.

The employment in common of technical methods for the development of agriculture is in part carried out under the care of the State Agricultural Administration, and partly by professional agricultural bodies. The central administration is under the Ministry of Agriculture, whose Director issues regulations for the encouragement of agriculture and stock-breeding.

The funds to be devoted to this work amount to 14 million crowns (1 crown = 13 ½ d. at par). The following are the chief items of expenditure: — direct grants towards the cultivation of the land, 3 millions; settlement (including "Ny Ford") 1 million; funds for the cultivation of uncultivated areas, 1 million; farm schools for peasants and training schools for country women, 2 165 000, the different districts contributing one quarter of the maintenance cost of these schools; staff salaries and travelling expenses 1 million; centres for field experiments, 487 000; depots for cereals and grindingstones, 650 000; grants for the construction and maintenance of fertilizer factories 300 000; grants to agricultural societies, 1 180 000; to stock breeding associations, breeders of pedigree cows etc., control of milk production and farm accountancy, 540 000; local agricultural offices, 200 000. The different districts also contribute to the last three items of expenditure.

The work of breaking up and colonising the land, has, of late years, contributed very largely to the development of agriculture.

In 1917 a special department of the Ministry of Agriculture was opened to stimulate and encourage agricultural production. At the same time a great deal was done to break up the vast uncultivated areas that exist in Norway and this is to-day the chief work of the department.

Between the years 1918-1923, 30 100 hectares of land have been broken up and brought under cultivation at a net cost of 106 million crowns, to which

the State contributed 30.3 millions, besides furnishing loans to the amount of 30.3 million crowns. Of this total area, 19 650 hectares were broken up between the years 1919 and 1920.

The greater part of the grants made by the State for the colonisation of the interior are administered by the association " Ny Ford ".

The professional agricultural corporations include a number of institutions and officials who are paid out of the State funds, or by contributions from the different districts, though some are paid entirely by the contributions of members :

(1) One of the oldest of these societies is the Royal Society for the prosperity of Norway (" Selskapet for Norges Vel "), founded in 1809. Beginning with a very wide field of activity, it gradually restricted its work and became what it is to-day, an essentially agricultural society. Various other societies (" landlniksselskapene "), became affiliated to it, but these are tending more and more to come into closer relations with the State, as the State subsidies increase. Up to the present the work of this society has consisted chiefly in the study of new questions and in the formation of new institutions, which, when fairly launched, come under the State. Recently the Society has undertaken more permanent work, such as scientific enquiry, and some propaganda work. It also holds conferences on agricultural questions of the day, and issues the monthly review *Tidskrift for det Norske Landbruk*. It is subsidised by the State to the extent of 190,000 crowns. The activities of the affiliated societies include all the principal branches of agriculture.

(2) The Agricultural Societies (" Landliksselskapene ").

The greater part of the grants made by the State towards the encouragement of agriculture, have been for some time administered by the agricultural societies. There is one such society in each of the 18 " fylker " or provinces. They mostly date from the end of the 18th century to the beginning of the 19th. They take an active part in the breaking up of the land, and since the reform of 1919, may be considered as being local provincial branches of the Ministry of agriculture. This close collaboration allows a large measure of decentralization which is a necessity, owing to the peculiar conditions of the country.

(3) " Ny Ford ". This association was founded in 1907 by various agricultural societies as well as commercial and industrial organisations, for the purpose of restricting emigration, and helping emigrants wishing to be repatriated. At present, however, it is chiefly concerned with internal land settlement. Various other associations of a local character also work for this end, all subsidised by the State. Up to July 1st 1922 the " Ny Ford " held 1635 hectares of land, of which it had distributed 1130. (N. KROSBY, Litt om de faglige tiltak for at fremme landbruget i Norge. *Nordiske Jordbruksforsking*, Vol. 1, suppl. 3, 1923).

826. **Catalogue of scientific periodicals in the libraries of Paris.** — Under the auspices of the Academy of Sciences and with the co-operation of the librarians of Paris, M. Alfred LACROIX has undertaken the publication of a Catalogue of scientific periodicals in the libraries of Paris to be known as " Inventaire des périodiques scientifiques des bibliothèques de Paris ". (*Comptes rendus de l'Académie d'agriculture de France*, No. 7, 1924.

827. **Works which have been awarded prizes by the Agricultural Academy of France.** — No. 8, 1924 of the *Comptes rendus of the Agricultural Academy of France*, in addition to the speeches by M. H. CHERON, Minister of Agriculture, dealing with the present conditions of agriculture in France, by Prof. VIALA, president of the Academy, upon the services rendered to agriculture by the study of agricultural science, and by M. SAGNIER, Permanent Secretary of the Academy on the work of the Academy during the year beginning March 1st 1923, contains reports on the following works which have been awarded prizes by the Academy :

F. HARTMANN, *L'Agriculture de l'ancienne Egypte*. (Agriculture in ancient Egypt).

AUGÉ-LARIBÉ. *Le paysan français après la guerre*. (The French peasant after the war).

L. LAUTENT. *Esquisse de géographie botanique du massif de la Sainte-Baume*. (A sketch of the botanical geography of the Sainte Baume mountains).

BLANCHON and DELAMARRE DE MONCHAUX. *Toutes les poules*. (Poultry of all kinds).

MONVOISIN. *La conservation des denrées périssables par le froid* (The preservation of perishable viands by refrigeration).

GUY DE BUEIL. *L'évolution de l'agriculture dans le Vexin normand depuis un demi-siècle*. (Fifty years of agricultural evolution in the Norman Vexin).

BOUIN. *Monographie de la région de Marrakesch (Maroc)*. (Monograph on Marrakesch [Morocco]).

LISSOT. *L'amélioration du bétail par le contrôle laitier*. (Stock improvement by means of milk control).

H. BRUN. *Le domaine rural, ce qu'il était autrefois, ce qu'il est aujourd'hui, ce qu'il devrait être*. (Farm property in the past, present and future).

PERRET-MASSONNEUVE. *L'apiculture intensive et l'élevage des reines* (Intensive bee-keeping and the breeding of queen-bees).

PORCHET. *Etude de l'écoulement souterrain des eaux*. (Study of deep water-springs).

G. CARLE. *Hydraulique agricole et industrielle en Syrie*. (Agricultural and industrial hydraulics in Syria).

There was also a report by M. H. LAFOSSE on the work of the " Société française d'économie alpestre ", dealing with the improvement of forest and pasture lands, and mountain gardens cultivated chiefly for forage, etc.

828. **The Ministry of Agriculture and of the Demesne of Roumania** has brought the balance for 1924 up to 628,000,000 *lei* with an increase, compared with that of 1923, calculated for 12 months, of about 105,000,000 *lei*. The increase in expenditure was divided as follows : 40,300,000 *lei*, bonus to officials to meet the high cost of living — 3 millions for the foundation of a new sero-vaccine Institute — 3,500,000 for the International Institute of Agriculture at Rome — 1 million for the industrialisation of fruit-culture, etc. (*Royaume de Roumanie, Ministère des Finances, Budget général de l'Etat pour l'exercice 1924*, p. 83, *Bucharest*, Impr. Globus 1924).

829. **The formation of " standards " in the United States.** — A recent circular issued by the Chamber of Commerce shows what has been done to

simplify the manufacture of products. Following the Congress of March 1923, the manufacturers of milk bottles adopted a uniform size and model which will be presented for the approval of the producers. Another congress held in March 1923 referred to the wide adoption of standard types for motor-car accessories and portable parts. In July 1923 standard types were established for wire netting and steel fencing, and their adoption became compulsory on September 1st 1923. A uniform type has been adopted for earthenware or terracotta goods, such as tiles, pipes, bricks etc., and paint and varnish pots. (Communication by the Secretary of the international Chamber of Commerce. *Bulletin économique de l'Indochine, Renseignements*, Year 28, No. 1, p. 25, Hanoi-Haiphong, 1924).

830. **Formation of standard types for cereals.** — The co-operation of the Colonial Institute of Marseilles with the department of Agriculture of the United States regarding the adoption of standard types, has resulted in a series of conferences between one of the chief officials of the standardisation services, Mr. PHILIP ROTHROCK, Representative of the Department of Agriculture of the United States, and a Commission which met at the Colonial Institute of Marseilles. The Minutes of the final sitting (5 February 1924) are published in No. 1273 (1924) of the *Cahiers coloniaux de l'Institut colonial de Marseille*.

The Colonial Institute of Marseilles has been considering for some time questions relating to the trade in cereals, which is a very important factor in the port activities of the city. Among these questions the methods adopted by some of the chief cereal producing countries for stabilising and regularising all commercial transactions relating to cereals are of chief importance.

The United States especially have organised the standardisation of their cereals in a manner that is particularly noteworthy. At the request of the French milling industry, the Colonial Institute of Marseilles has entered into communication with the Department of Agriculture of the United States, in order to be able to give accurate information to the French millers and flour factors as regards the working of the American System. The Department of Agriculture has supplied the Institute with full information, and has sent over some sample types to show how standardization works in practice. Mr. ROTHROCK has also been appointed as delegate to the Colonial Institute of Marseilles, to examine in conjunction with the representatives of the industry at Marseilles, the difficulties of interpretation to which these standards of American grain might give rise, and to supply any information necessary.

The need for a uniform type has been felt since grain elevators (co-operative granaries) were built in the United States. The chief producing states established model types for the principal varieties of grain grown by them; but very soon serious difficulties arose, both as regards internal trade and foreign export. The Federal Department of Agriculture decided therefore to undertake on its own account the establishment of standard types for the whole of the Union. This entailed considerable labour upon the departmental experts, which resulted in the fixing of the first national standards, which became operative in the summer of 1917.

After trial for a year, the Department of Agriculture found it necessary

to introduce certain modifications in the definition of the terms and qualities required by the different grades; it completely revised certain sub-classes, and issued regulations which came into force from July 15, 1918, and are still operative to-day.

Grain, in the United States, is divided into six grades, the greater number of which are sub-divided into two or three sub-grades. In every grade or sub-grade, are six standards, for certain specific qualities, such as specific gravity, percentages of water, impurities, etc.

Corn may be sold on sample in the United States, but if the commercial transaction takes place on the basis of a system of grades, the use of the official types is obligatory.

The technical services of the Department of Agriculture have established in a certain number of towns centres for inspectors, whose business it is to classify the commercial grain. These inspectors are required to pass a severe examination, and are accorded a diploma which qualifies them for exercising their profession.

All the consignments of grain which reach the elevator are examined by an authorised inspector, who determines the class and grade. A sample is required to be sent to the official central Verification Service at Chicago. The supervision of the licensed inspectors is under the care of the technical officials of the Department of Agriculture. If an inspector is found to be incapable or inefficient, his licence is forfeited. If he is found guilty of fraudulent practices, the Department gives the case the greatest possible publicity. These inspectors are not paid by the exporting Firms, but by commercial Corporations, such as the Commercial Exchange, etc.

If a foreign buyer receives grain which does not correspond with the grade certificate furnished by the inspector, instead of his taking proceedings at law, the Department of Agriculture will receive any complaints that the buyers shall deem justifiable. The Department takes full account of each case, and if necessary, inefficient inspectors lose their licenses.

In studying the standards of grain of the United States, the use of the terms " hardwheat " and " durum wheat " calls for attention. The adjective " hard " should not be translated as is usually the case by " durum ". The Americans call " hard " the stronger grain of the ordinary type (*Triticum vulgare*). Only the " durum wheats " correspond to our so-called " hard wheats " (*Triticum durum*).

The rules for standard types require that wheat of the durum class should contain at least 90 % of different varieties of durum. All grain of the type *T. durum* is classed as " Durum wheat " without taking into account the proportion of abnormal soft grain contained, even if the whole is soft; so that when buying " Amber Durum No. 1 ", which is the best quality of hard wheat of the United States standard, the purchaser is not certain of obtaining more than 75 % of hard flinty grain.

The question of the presence of soft grain among the hard is regarded more seriously by the grain industry of Marseilles, which requires for example that the hard wheat of North Africa should contain not more than from 10 % to 15 %, according to the season, of soft grain; while for the hard grain of India, any grain showing even a single white mark, is reckoned as soft grain.

This difference between the requirements of the French corn factors, and those of the United States is due to the fact that their industrial methods are not the same.

831. **Standardisation of weaving fibre in the Philippines.** — A new regulation came into force on February 8th 1923, through the " Administrative Order " No. 25, which is published *in extenso* in No. 2, second quarter, 1923, of *The Philippine Agricultural Review*. This " Administrative Order " refers chiefly to " abaca " fibre, or Manilla hemp (*Musa textilis*) unsteeped, " maguey " (*Agave Cantala*), " sisal " (*A. sisalana*) all steeped, and certain other fibres known as " pacol " and " Canton ".

Standardisation is based on the following qualities : breaking load (expressed in grammes per metre of fibre representing 1 gram), colour, purity of fibre (quantity of wood remaining adherent), and secondly on the weaving quality and length). The balls are classified according to place of origin (11 districts) and weight (15 kg.) and dimensions (m. 1 × m. 0.50 × m. 0.50) which are definitely fixed.

Classification is made under Government control, at the classifying centres (44) or in places furnished with special licenses. The control is in the hands of the head of the Division of Fibres of the Department of Agriculture. If complaint is made, a committee of the Department is formed, with the approval of the Secretary for Agriculture and Natural Wealth. (*Les Cahiers coloniaux de l'Institut Colonial de Marseille*, No. 280, 1924).

832. **Plants which produce alcohol for carburisation.** — In Italy and the Italian colonies are to be found, as Doctor Mameli Calvino points out (Colonial Agriculture *L'Agricoltura Coloniale*, No. 12, 1924) : prickly pear (*Opuntia ficus-indica*) — sugar cane (*Saccharum officinarum* and *S. Spontaneum*) — " mandioca " or manioca (*Manihot utilissima*), cultivable in Sicily, as was shown at Colonial Garden at Palermo — " agaves ", and especially *Agave Salmiana* (from the sap which flows from the plant after cutting off the flower buds) — gigaro (*Arum italicum*) — cannarecchia or sorgagna (*Sorghum Halepense*) — Jerusalem artichoke (*Helianthus tuberosus*) — certain varieties of dahlia — sweet potato (*Ipomeae batatas*) — igname (*Dioscorea* spp.).

833. **Tunisian Alfa.** — The Government of Tunis is considering the means of obtaining considerable benefit by developing the Tunisian alfa plantations. The authorities propose to make large concessions, such as have been made in Algeria.

The average annual exportation of alfa, which was not more than 33 000 t. before 1920, is to-day about 60 000 t., almost exclusively for England.

The decree of December 24th 1921 exempted from export duty all raw alfa and alfa pulp sent from Tunis to France. By the law of May 19, 1923, similar facilities were granted for cellulose pulp coming from Tunis. By the decision of the Director General of Public Works of the Regency of November 21, 1923, a reduction of tariff is allowed on railways for alfa specially directed to the factories at Tunis for conversion into cellulose pulp. (*Les Cahiers coloniaux de l'Institut colonial de Marseille*, Nos. 276 and 277, 1924).

834. **Results of the sales of cork in Algeria in 1923.** — The quantities offered for sale amounted to 67 916 q. at Costantine, 33 338 q. at Algiers, 2 891 q. at Oran, or a total of 109 238 q., of which 93 086 q. represents the

1923 crop, and the rest the unsold remainders of the years 1922, 1921 and 1917. The total quantity sold amounted to 96 747 q., the total price obtained being 7 792 741 fcs. (*Ibidem*, No. 269, 1924.

835. **Three Malt-Works in Italy:** at Pedavena (prov. of Belluno), Avezzano (prov. of Aquila) and Brescia. They can produce 60 000 q. of malt while the actual requirements for 1924 are estimated at 400 000 q.

836. **The Adoption in France of the Danish method of fat analysis in milk.** — The HÖYBERG method (see *R.* 1923, No. 775) is at the present time adopted in France by six associations for the control of milk production. The results given may be compared with those of the GERBER method; each analysis costs 0.10 fr. (*Comptes Rendus de l'Académie d'Agriculture de France*, No. 10, 1924).

837. **Gloss or artificial Silk.** — At a recent meeting held by the "National Retail Dry Goods Association", and at which the "Silk Association of America", the "National Knitted Underwear Association" and "The Association of Knit Goods Manufacturers" took part, it was decided henceforward to give the term "gloss" to artificial silk, which should be considered as a distinct weaving fibre.

838. **Market for Raisins in China.** — Twenty years ago the sale of American raisins in all Southern China did not exceed 1000 boxes of 45 lbs. each. These sales were practically confined to the foreign residents of Hongkong. The 1924 sales in Hongkong will probably exceed 50 000 cases, practically 90 % of which will be imported from the United States and the balance from Australia. Fully 90 % of the Hongkong imports are re-exported to interior points. The reasons for the large increase in sales are that, by persistent advertising and the adoption of satisfactory sales methods on the part of American exporters, the native Chinese have become gradually educated to the use of raisins as a sweetmeat.

The raisins are shipped to representatives of American firms in Hongkong who, in turn, place distribution and sales in the hands of well-known Chinese firms who have connections in Canton, Amoy, Foochow, Wuchow and other cities. These Chinese firms enjoy the exclusive sales rights by written contract. (*Crops and Markets*, Vol. 1, No. 15, 1294, Washington).

839. **For the international regularisation of the cheese trade,** the following recommendations were formulated and presented by a commission appointed by the Italian Section of the International Dairy Federation, at the World Dairy Congress held at Washington (October 1923):

This Congress, recognising the advantage of placing the cheese industry under definite international control, recommends that in every country or state: [1] there be established a minimum of fat in the percentage of dry material of the cheeses made with unskimmed milk generally exported; [2] that cheeses made from partially skimmed milk be marked to show the proportion of milk that has been skimmed (the cheeses being indicated as made from half, three-parts, or four-parts skimmed milk, etc.); [3] that studies should be encouraged to ascertain the quantity of water present in the different types of cheese and at their different stages of ripeness, for the benefit of the cheese trade. The Congress also decided [1] that the origin of the cheese should be clearly indicated, the indications to include the name of the type of cheese and of the country

in which it is manufactured. (*Records of the experimental Cheese Factory at Lodi*, Vol. II, No. 5-6, pp. 153-157, Lodi, 1924).

840. **Balloons for the study of the spread of insects.** — Dr. E. M. FELT chief entomologist of the New York Conservation Commission, announces that thousands of toy balloons will be released early in May from fifteen temporary weather stations located along a wide front extending from northern Connecticut nearly to the Canadian border, in an effort to discover the secrets of the winds responsible for the westward spread of the tree-destroying gipsy moth.

The gypsy moth has proved such a destructive insect in New England and New York that the State Conservation Commission, in cooperation with the Federal Government has established a barrier zone in an attempt to stop its westward spread. In spite of the fact that this pest is a winged insect, it does not occupy new territory through its power of flight. The females are unable to fly on account of the extreme weight of their bodies. The big spread comes when the young caterpillars are first hatched from the eggs. These caterpillars have long hairs growing out of their bodies. These hairs, it is thought, together with the silk which the caterpillars spin, help to buoy them up in the wind which sometimes carries them from a half mile to five miles from their starting place.

Last year, to learn about the winds which caused this casual spread of the caterpillar aeronauts, 7000 hydrogen-filled toy balloons were sent up. Each balloon bore a numbered tag requesting the finder to return it with a record of the time and place where found. Over 400 tags were returned by the end of the season. They were found practically throughout southern New England, a number being picked up on both the eastern and southern coasts. One balloon was found off Yarmouth Cape, Nova Scotia, a drift of about 400 miles in 18 hours. Seven covered distances of 110 to 145 miles. One drifted 65 miles at the rate of 100 miles an hour. Another remained in the air six and a quarter hours and then dropped at the point of release evidently carried back by a counter current. One season's work was thought insufficient to justify definite conclusions with such variable factors as the winds, and the investigations are to be continued this spring on a more extensive scale. (*Science*, No. 1532, p. XII, New York, 1924).

841. **The destruction of locusts.** — At Potchefstroom (Transvaal) many trials have been made of a new machine called " Locuvatore ", invented by the brothers VAN MAARSENBROEK of Standerton, designed to destroy locusts and many other kinds of insects which can be used in commerce. A trial was made with great swarms of " attere " locusts (" voetgangers "). The machine consists of two canvas wings 75 m. long which are pegged down to the ground at an angle of 45 degrees ; from a raised base, an elevating " apron " is fixed at each side in such a way that the column of locusts is lifted up in the apron into a box at the top, whence the locusts are easily gathered ready for sale. (*Les Cahiers coloniaux de l'Institut colonial de Marseille*, No. 266, 1924).

ALFREDO RUGGERI, *gerente responsabile.*

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NOTE. — The Bureau assumes no responsibility with regard to the opinions and the results of experiments outlined in this *Review*.

The Editors notes are marked (*Ed.*); the letter *R.* indicates the references to the foregoing issues (Monthly and Quarterly) of the International Review.

ORIGINAL ARTICLES

THE MEASUREMENT OF SOIL ACIDITY AND ITS IMPORTANCE IN PRACTICAL AGRICULTURE.

In the *International Review of the Science and Practice of Agriculture* (1923, art. 332), there appears an abstract of an article describing the method of measuring soil acidity by my apparatus, constructed according to COMBER'S principle. The liberty is now taken of making some remarks upon the importance of the measurement of the acidity of the soil for practical purposes.

In the first place, I wish to state again that this method, based on COMBER'S principle, is not sufficiently accurate to give the exact degree of the acidity of the soil. It is only an empirical method. On comparing the results obtained by the COMBER method with the pH data found by Dr. Jac. VAN DER SPEK by the help of the electrometric method, an approximate relation was found between the pH of the soil and the colours assumed by reagent I. But, because my method is empirical, the testing of the pH figures is always a necessity, especially in the case of new types of soil.

This method is to be used, in the first place, to determine the degree of acidity in different plots on a farm, in order to discover the degrees of acidity of different types of soil that are favourable to the development of various kinds of plants and thus to connect the degree of soil acidity with the extent of plant growth on different soils.

As already stated, it is necessary, in these statistical investigations, to start with the plots where the plants have grown best. Naturally, it is advisable to take two soil samples from the same soil (choosing two places at short intervals apart where the same type

of plant has grown well and badly), and then to determine the acidity of the two samples of soil.

In this work, it is necessary to enlist the co-operation of farmers. All data relative to the type of soil must be known, together with the situation of the land, and its manurial and drainage conditions.

The question has been asked on several occasions, whether this method can serve also to determine the amount of lime required by an acid soil.

This amount of lime does not, however, depend upon the momentary acidity of the soil in question, but also on other factors.

First of all, the degree of acidity to be estimated in the soil under discussion, must be fixed. For instance, more lime is needed to obtain a pH 7.5 reaction (slightly alkaline), in the case of a soil of 4.5 pH degree of acidity, than to raise the same soil from 4.5 pH to 6.5 pH (very slightly acid).

The number of gm. of CaO required to impart a slight degree of alkalinity to 100 gm. of dry soil (the surface liquid in the soil gives a very pale pink colour to phenolphtalein), has been termed by me, the *lime factor of the soil*. If, however, we determine the amount of lime necessary to neutralise exactly the soil acidity (pH = 7), we then obtain the lowest " lime-factor ". It is clear that the question of the " lime-factor " required by the soil is connected with the optimum degree of soil acidity for any given plant.

The statistical researches mentioned above are rightly directed to collecting many more data on this subject. In the meantime, we may try provisionally to obtain a weak acid reaction in the case of a humus soil and somewhat neutral, to weak alkaline reactions, in that of a clay soil.

If the degree of soil acidity required for a given soil and certain plant is fixed once for all, then the " lime-factor " depends on the initial acidity of the soil in question and on the amount of humus, or of clay, that it contains. Thus, in the case of two soils of equal acidity (for instance pH 4.5), but having respectively a high and a low humus content, the first will require more lime than the second in order to attain the neutral reaction pH 7. It must be added that the character of the humus plays a certain part also in the reaction.

If the degree of the soil acidity and the quality of the soil (percentage of humus, etc.) are known, it is easy to obtain some idea of the " lime-factor "; although absolute exactness in this respect can only be reached in a laboratory experiment. There are many methods

for the accurate determination of this "lime-factor." CARR (1) has also based a method of determining it upon the COMBER principle.

In the meanwhile it may be stated that laboratory researches on the "lime-factor" of soil, do not interfere with the great and lasting significance of the practical estimation of the degree of soil acidity.

The matter cannot be better explained than by giving some practical instances.

A farmer desirous of knowing the lime requirements of his land, having set out by the COMBER method, 18 plots (5 types of soil) on his farm, found that 14 of these plots were neutral, or slightly alkaline, 3 were very slightly acid (reagent 1 slightly tinged) and one slightly acid (reagent 1 pale reddish). He was advised, in the case of the last plot, to send a sample of the soil to the laboratory for examination, but as the acidity was very low and the potatoes had done well, he thought it was not necessary to carry out my suggestion. Had he not adopted the COMBER method, he would have been obliged to forward 18 samples to be tested.

Another farmer living in a district where all the soil was of one type found that it had a reaction ranging from a strong acid (pH = 4-4.5; with reagent 1, colour dark-red, nearly opaque) to weak acid (pH = 5.5 6). He was then advised to take some samples, getting his neighbour to do the same, and to send them in lots of three (a very acid, an acid and a slightly acid sample) to the laboratory.

In this way, it is possible to limit the number of samples to be forwarded, which encourages the farmers to adopt the method, for at first they are disinclined to incur the trouble and expense of taking soil samples and forwarding them for analysis.

Even after the "lime factor" has been determined, COMBER'S method of soil acidity estimation is useful, because it enables the results obtained by a given fertiliser to be tested. A part of the fertiliser may have no effect upon the soil and thus be wasted, whereas another part may produce an effect immediately, or perhaps, during the course of the year. We have already obtained some data illustrating this point.

The regular testing of the variations taking place in soil acidity as the result of the action of any given fertiliser is of paramount necessity, but the farmer can do this work himself with the help of the COMBER apparatus.

(1) R. H. CARR. Measuring Soil Toxicity, Acidity and Basicity. The *Journal of Industrial and Engineering Chemistry*, Vol. XIII, No. 931 (1921).

When the different fields on a farm have been brought to the desired degree of acidity, then the value of the COMBER method is chiefly shown. Every year, preferably in September, when the crops have been carried and the stubble has been ploughed in, the farmer can estimate the soil acidity. According to the results obtained, he knows whether the land should be dressed with ammonium sulphate, or nitrate of soda, with superphosphate, or basic slag, or whether an application of lime, marl, sludge etc., is more advisable.

In the above few remarks an attempt has been made to show the constancy of soil acidity determinations made by the help of the COMBER apparatus and their value to the farmer.

The task, however, would not have been complete if no mention had been made of another great advantage possessed by this method which has resulted from its application by farmers themselves, and has contributed in a great measure to their own development. Nothing stimulates love of science more than personal investigations. These investigations may, at first, be somewhat incomplete, but they improve in course of time, especially if well-directed by the persons entrusted with their supervision, viz., the State Agricultural Authorities, Professors of Agriculture and Horticulture, the Administrators of Agricultural Societies and other persons of influence in the domain of agriculture.

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THE UTILISATION OF SEEDLINGS IN THE ESTIMATION OF SOIL NUTRIENTS.

The farmer has learnt how the yield of his cultivated areas can be increased annually by unremitting toil, attention and capability, better methods of tillage, use of improved seed, the prevention of plant diseases, and above all by the liberal application of fertilisers. The farmer used to follow the approved advice of PAUL WAGNER (Darmstadt) and gave his fields only a limited amount of nitrogen, which was expensive, and cannot be retained by the soil, while he applied an excess of potassium and phosphoric acid, without considering whether the repeated manuring with these fertilisers had not satisfied the potassic and phosphoric requirements of the soil to the extent of rendering it advisable to diminish the amount employed. This carelessness was due to the fact that the potassium and phosphoric acid were cheap and easily obtained. Those days are now past, and the universal economic depression has extended to agriculture, so that the farmer can no longer indulge in the luxury of wastefulness, but is obliged to exercise the strictest economy not only in the management of his capital above ground, but also in the use of the valuable stock of plant nutriment that lies hidden in the soil. To employ this treasure aright necessitates a thorough knowledge of its character and value, but unfortunately the agriculturist is still ignorant of its nature and importance in spite of all the efforts of science and of the practical investigations that have been carried out.

Hitherto, three methods have been employed for determining the nutritive substances present in the soil : pure chemical analysis, manurial field experiments and vegetative experiments with plants in pots. All these methods have proved inadequate for the purpose. Chemical analysis is in the first place far too rough a test, for the soil chemist can only analyse correctly up to hundreths per cent., his results being inaccurate for thousandths per cent. Since, however,

the soil over 1 hectare of surface taken to the depth of the plough furrow weighs about 3 million kilograms, one thousandth per cent. is 30 kg., and an error of five thousandths per cent., a mistake easily made, would give 150 kg. which is far too high a figure. Chemical analysis is also unreliable for another reason; the chemist can determine without difficulty the total amount of any nutritive substance contained in the soil, but he is unable to state how much of it can be taken up by the roots and assimilated by plants, which is the important point. No certain results have hitherto been obtained from the chemical soil analyses made for the purpose of ascertaining how much nutritive matter the weak efforts of plants have succeeded in wresting from the soil. If any chemist were to affirm to the contrary, he would probably not find a single practical agriculturist ready to believe him, for unwavering confidence in the case of such predictions is more difficult than under any other circumstances, because the store of nutritive substances present in soil is not the only growth factor. The crop-yield depends upon other conditions, especially upon the weather, therefore even if the estimate of the amount of nutritive substances in the soil were correct, there would not infrequently occur a discrepancy between it and the harvest, and it would need great faith on the part of the practical agriculturist to realise that the difference in the theoretical and the calculated values, was not to be attributed to the mistake of the soil-analyst.

Therefore let us dispense with all chemical methods. Plants alone are able to give a reliable answer to our questions. Field manurial experiments and pot-cultures are the only forms in which the problem has hitherto been applied to plants, and such methods will always be valuable for soil investigation and throw light upon the subject of plant nutrition, but unfortunately, they are troublesome and lengthy. Any one who has conducted manurial experiments in the field is well aware of the difficulties they present. Very often these experiments are interfered with by the weather, so that accurate results are only obtained if the researches are extended over several years. Pot-culture experiments are less dependent upon weather and have reached a high stage of perfection, but they require an extensive and special equipment which few Institutions possess and could now only be purchased with difficulty owing to the high cost of material. Further, pot experiments are very long and troublesome and hence expensive; therefore, it is quite impossible for agriculturists to obtain by this means, and within reasonable time, any general information

respecting the nutritive substances content of their cultivated soil. Hence there is urgent need of a method of mass experiment, by which any Experiment Station can carry out, without new, costly apparatus, hundreds and even thousands of soil sample analyses, to determine the nutritive substances present in them which can be assimilated by plants. Farmers should be given the opportunity of forwarding samples of their soil at all seasons, in summer as well as in winter and these samples must be quickly, cheaply and accurately investigated, just as fertilisers and stock-feeds are tested. In this way, it will be possible, not only for the few favoured individuals who are in a position to conduct plant experiments, but also for the great mass of agriculturists, to suit the fertilisers applied to the requirements of their various soils and thus to farm systematically, a result that is of paramount importance, both from the point of view of national economy and the nation's food supply.

The principle upon which is based the carefully worked-out method (1) devised by myself and my colleague Dr. WILH. SCHNEIDER (Bonn), is the hitherto unknown fact that young seedlings do not live as long as possible upon the reserve materials of the seed, but employ their rootlets, as soon as they are developed, to obtain nutritive substances from the soil.

If a large number of young seedlings are planted in a small quantity of soil, the starving rootlets extract all the assimilable nutritive substances their strength permits, but leave untouched the non-assimilable matter. In this manner, the plant rootlets separate out the soluble from the unsoluble substances, thus rendering a valuable service also to the chemist, since their choice is certain and leaves no room for doubt.

Our experiments were conducted as follows :— Upon the level bottom of some small glass dishes measuring about 100 sq. cm. at the base and 6 cm. high, were spread 100 gm. of the soil to be tested, mixed with 50 gm. of pure quartz-sand, the so-called "glass-sand", which is free from any nutritive substances. Over this was laid 250 gm. of damp glass-sand, and upon the smooth surface were planted 100 seeds of the best, heavy, seed-rye. The seedings soon germinated ; they were carefully tended, and removed with their rootlets after 17 to 18 days and analysed. Only part of the mineral

(1) "Die Nährstoffaufnehme der Keimpflanzen und ihre Anwendung auf die Bestimmung der Nährstoffgehalts der Böden". *Zeitschrift für Pflanzenernahrung und Düngung*, Part A. 2, Year 1923, No. 5. Leipzig.

substances entering into the composition of the seedlings thus came from the soils to be tested, for a considerable amount was derived from the reserve stores of the seed. For this reason, we also carried out a blank experiment on barren sand to which no soil had been added and substracted the nutritive substances found from the total before obtained. The remainder was clearly derived from the soil.

So far, we have only used this method for the determination of potassium and of phosphoric acid, but we are convinced that it could also be employed in the case of other nutritive substances, such as nitrogen, for instance. The amount of phosphorus yielded up in this manner to young rye-seedlings by 100 gm. of soil, ranges, according to observations made, from 5 to 100 mg., while the phosphoric acid varies from 0 to 25 mg. Since 1 mg. per 100 gm. of soil is equivalent on an average to 30 kg. per hectare, the young seedlings on 1 hectare of soil abstract from the soil up to 3000 kg. of potash and up to 750 kg. of phosphoric acid in 18 days. These amounts appear very large at first sight, but in reality they are very small. The seedlings used in the experiment were starving, which was necessary, otherwise they would not have exhausted the soil, but plants under natural conditions take up a much larger amount of nutritive substances in the same short space of time. The reason that they do not exhaust the soil to an equal extent is simply that our cropping plants naturally have a thousand times as much soil at their disposal Parallel determinations made according to the new method agree as exactly as chemical analyses, provided they have been executed by skilful and trained persons.

As can be seen from this brief description, the new method not only has the advantage of being quickly carried out by means of small packets of soil samples that can easily be forwarded by post, but it also has another point in its favour. Whereas in other vegetation experiments it is necessary to insure the optimum condition of the growth factors that are not involved in the test, and to supply an excess of all the nutritive substances not under consideration, in this new method all that is required is water and warmth. Especially good illumination is not even essential. In this manner, the carrying out of the experiment is greatly simplified, there is no danger of producing unwelcome changes in the soil by the addition of other matters and it is thus possible to use the same material for the determination of the root-solubility of many nutritive substances instead of being necessary, as hitherto, to fit up the experiment anew for each fresh

compound. In the usual type of vegetation experiment, the amount of nutritive substances contained by the soil is estimated from the yield of plant substance when the plants are gathered. Therefore the nutritive substances in question must not only have been taken up by the plants, but also turned to excellent account, which according to the " law of minimum ", or as it is now called the " law of the influence of growth factors ", is only possible when all the growth factors not involved in the test are at their optimum. By this method, however, there is no need to ascertain what the plants do with the nutritive substances they have absorbed from the soil, it is sufficient to ascertain the amount they have abstracted. Fortunately, the law of the influence of growth factors, which is so troublesome in other experiments, does not appear to affect the mere abstraction of nutritive soil substances by very young seedlings that still possess a large store of reserve material. We may imagine the plants saying, " let us diligently collect only stones for building and we shall soon find means of using them ". In the open fields also, the first efforts of the germinating seed in early spring, are directed to collecting building material to be used later, when the chlorophyll apparatus has become strong, under the influence of more intense irradiation.

From what has already been said, it is clear that a much larger number of tests can be made by the new method of vegetation experiments than was possible to carry out with the old systems ; further, the experiments can be conducted at all seasons of the year. One important question, however, remains to be answered, viz., is the new method accurate and trustworthy ? That it is based upon existing laws has been shown by the agreement of parallel experiments and the great differences in the data obtained in the case of soils of unlike composition. How far this method is practically feasible must be decided by comparing the results obtained with those found by means of field manurial experiments, but as these are themselves affected by several sources of error, it is advisable to take the soil samples from experiment fields that have been long under observation. This has in fact been done, and I have always requested my colleagues when forwarding such samples, not to give me any information respecting the nature of the soil and its condition as regards fertilisers, until I have reported the findings of my experiments and made my calculations. They invariably complied with my wishes, with the results that will presently be given.

In order to determine by the seedling-method the nutritive sub

stances required by a soil, it is needful to know how many mg. of each nutritive substance must be contained by an amount of the said soil, corresponding to 100 gm. of dry substance.

Judging from our present experience, we are of opinion that the *highest* yields can only be obtained from the plants in question (in the absence of potassic or phosphatic fertilisers), when it is possible for the seedlings to abstract, from a quantity of soil corresponding to 100 gm. dry substance, the following minimum amounts :

	Potassium	Phosphoric acid
	mg.	mg.
Rye, Wheat	14	8
Barley, Oats	18	7
Red Clover	29	9
Lucerne	34	13
Meadow plants	38	10
Potatoes	37	10
Sugar-beets	39	12
Mangels	60	14

It is necessary to remark that these limits are based upon a general estimate and must be supported by the evidence of further experiment.

They apply to arable soil of the medium depth of 25 cm., where no nutritive substances have been added to the subsoil. It is of paramount importance that the amounts of nutritive substances supplied are enough to produce a maximum yield. Should it be impossible to obtain a maximum crop owing to the mechanical composition of the soil tested, or to the climate or lack of water, smaller quantities of nutritive substances that can be assimilated by plant roots will be sufficient. Therefore the data obtained from the seedling-method cannot be used as a general scheme. This objection applies not only to our method, but also to all other artificial systems. Field manurial experiments are indeed free from this limitation, but they have many other drawbacks.

The testing of our new method by the investigation of soil samples from experiment fields of known condition as regards fertilisers, included 65 potassium and phosphoric acid determinations. Most of the data are given in the above-mentioned treatise and as space is lacking here to reproduce the tables, it is only necessary to state that

the agreement between the figures found and the condition of the fertilised fields, was in every case very satisfactory.

The following facts have not hitherto been published. The figures represent the amounts (in mg.) of potassium and phosphoric acid found by means of the seedling method in a quantity of soil corresponding to 100 gm. of dry substance. The experiments were conducted in the experiment field of the University of Halle (Saale). This field had been planted with rye uninterruptedly since 1879; it was manured annually with stable-manure and also with chemical fertilisers.

Kind of Fertiliser	Potassium	Phosphoric acid
Unmanured	9.9	5.1
nitrogen alone	7.2	3.5
8000 kg. stable-manure	18.0	6.8
12 000 kg. » »	22.2	8.3
Complete mineral fertiliser without nitrogen	35.0	15.0
Complete mineral fertiliser	30.6	16.7

The figures agree very closely with the actual conditions.

Experimental field of Gottingen University.

The field had been planted with regular rotations of crops for 30 years and manured during that time as follows. No lack of potassium was noticeable (except, in the case of very exacting plants), even on the plots that had received no fertiliser.

Kind of Fertiliser Used	Potassium	Phosphoric acid
Unmanured	29.1	19.7
Nitrogen only	21.7	14.8
Phosphoric acid only	26.2	25.1
Potassium only	56.0	19.5
Complete fertiliser without potassium	25.5	17.4
Complete fertiliser without phosphoric acid	57.5	19.3
Complete fertiliser without nitrogen	61.9	22.0
Complete fertiliser	59.4	21.4

Here again the experimental results were a true reflection of the soil conditions as regards manuring.

EXPERIMENT STATION OF THE AGRICULTURAL COLLEGE («LANDWIRTSCHAFTLICHE HOCHSCHULE») OF BONN-POPPELSDORF, BONN.

The experiments have been in progress since 1896. No lack of phosphoric acid has been shown even on the unfertilised plots. On the plots without potassium, the yield was little decreased in the case of wheat, but was much lower than usual in some instances where the crops were of a more exacting character. The fertilisers were not heavily spread as in the case of the Göttingen experiments but the amounts given were calculated to replace, as far as possible, the substances abstracted by the crops.

Kind of Fertiliser	Potassium	Phosphoric acid
Complete fertiliser without nitrogen .	24.5	15.8
Complete fertiliser without potassium	14.8	14.9
Complete fertiliser without phosphoric acid	25.6	9.0
Complete fertiliser	22.3	11.3

The figures found gave a very accurate conception of the condition of the field as regards fertilisers.

Soil composed of weathered Bunter-sandstone : field manurial experiment with winter-barley ; previous crop five-year lucerne. The figures obtained were : potassium 54.6 mg., phosphoric acid only 4.0 mg., therefore the soil must be regarded as very rich in potassium, but poor in phosphoric acid. The field manurial experiments gave the following results :

Unmanured	2950	kg. grain
Manured with nitrogen and potassium	3090	» »
Manured with nitrogen, potassium and phosphoric acid	4720	» »

Here again, the manurial condition as shown by the behaviour of the young seedling method was fully confirmed by the field manurial experiments.

The new method will be further extended with a view to the determination of the lowest values that will provide the amount of nutritive substances necessary to completely satisfy the requirements of different plants under various conditions of soil and climate, even in the case of a maximum yield. Whether rye is the best plant to use in these researches, will also be investigated, and whether it is sufficient to keep to a single variety of plant throughout the experiment.

The success already attained inspires us with the hope that this new method will be adopted in all Agricultural Experiment Stations, as being a valuable aid to research, and useful in giving every farmer the opportunity of obtaining a clear idea of the store of nutritive subtances present in his soils. It is hoped also that the scope of the new method will be further extended, for we believe it will prove of great service and enable us to penetrate quicker and deeper than heretofore into many of the domains of soil science and of plant physiology.

H. NEUBAUER,

Agricultural Experiment Station, Dresden.

SEED TESTING IN RUSSIA.

Northern Russia.

The first Seed Testing Station in Russia was founded on December 15th 1877 in the Botanic Gardens, St. Petersburg (Leningrad) at the suggestion of Prof. Bataline, who became later the Director of these Gardens and is well known for his botanical treatises. After his death in 1893 Prof. Klinge was appointed as director and since 1902 the work has been in the hands of the writer. Since the commencement, stations have been established at Warsaw, Riga, Moscow and other towns.

For a long time the station at St. Petersburg was limited to a section of the botanical laboratories in the Botanic Gardens, and it was only in 1902 that circumstances permitted the installation in an independant building, which although not large, was at least well adapted to scientific work and the microscopic analyses of seed and seed products. The personnel was gradually increased and at present about twenty are engaged in these investigations. The work is not essentially confined to analyses of seeds, as the absence of obligatory control does not necessitate the distribution of certificates to the cultivators who are expected to guarantee the quality of the seeds put on the market. Consequently, not being in close contact with the establishments concerned with the sale of seeds, the Station does not receive a constant supply of seed samples for analysis. The type of samples received has been confined therefore chiefly to seed used for annual exhibition purposes, and also samples sent by the Department of Agriculture occupied with the question of purchase of seeds for the testing Stations. The quantity of seed samples sent by private persons, has never been very high and has not exceeded 1000-2000. The exhibition material is usually distinguishable by its superior quality, and as a result it is possible to judge the standard which can be reached in certain types. Material examined carefully from the

standpoint of origin, has made it possible to estimate the average quality of seeds from the Government records of the past 40 years.

If the actual examination of seed destined for sale, occupies only the second place, the predominance is given to the resolution of different problems having a close bearing on the methods of seed analyses and the propagation of reliable information showing the methods of control adopted in other countries, and the training of the required personnel, who must necessarily, have a through knowledge of spermatology. The activities of the Station, at the start under the direction of Prof. BATALINE, were of a somewhat peculiar nature. A series of monographs were published dealing with plants cultivated in Russia: Cruciferae, Leguminosae, etc. Later, this work was transferred to a special Bureau of Applied Botany and the Seed Station was able to concentrate all its attention on the study of the physiology of seed germination and the elaboration of testing methods.

As regards this last work, the Station has achieved certain interesting results, which are presented in the Review published by the Station in 1912 (" Annual Report of Seed Trials ") and it appears that this is the first publication dealing with such questions. The War and subsequent events have hindered the regular publication of this Review, but there has been no lack of material collected.

In addition to this Review, the Station has published several pamphlets giving a description of the Station and its activities, and articles have been introduced into other journals. Three large wall diagrams were finished before the War, but since then this form of work has not been recommenced.

During 1915 a Course for Seed Testing was organised, with a view to the training of students in natural history and agricultural science, especially the methods of seed analysis and the elements of spermatology. Hence the reason for bringing to public notice the courses on physiology of seed germination, the morphology and anatomical structure of seeds ; the transmission of disease by seeds, the microscopical analyses of seed products, etc.

Many of the qualified students were afterwards employed in the Seed Testing Stations and others utilised their knowledge in the various seed depôts, etc.

In addition, it should be observed that the Station undertakes the microscopical examination of seed cakes.

The foregoing may be taken as a short survey of the characteristic development and activity of the Seed Testing Stations which may be said to represent a seat of scientific research dealing with spermatological questions.

As already mentioned, after the Station in Leningrad was well established, other Stations were started elsewhere. One of the best of these is situated at Kieff, although the War has interfered with the complete installation. The Stations are chiefly under the control of Agricultural Societies and only in a few cases are attached to Agricultural Colleges and similar Institutions.

At the present time, the Soviet Socialist Republic includes certain independant republic States in which 25 Stations are situated.

In conclusion, the writer draws attention to the fact that the State Seed Service in Russia attributes distinct importance to all Congresses dealing with selection and spermatology and at the Congress held at Kharkoff in 1911, the urgent necessity of regulating the purity of seeds on the market, was emphasized. Hence the importance of developing the organisation of the State Seed Testing Stations, the issuing of obligatory decrees, the regulation of the sale of seeds, and the fixing of uniform methods of seed testing.

At the Congress held in St. Petersburg in 1912, these questions were still further discussed. Reference was made to the proposed Law under the direction of the Department of Agriculure for the control of falsification, and it was agreed conditionally to follow the rules of seed testing issued by the German Agricultural Stations, as these were already published in the Russian tongue. At the writer's request in 1917, a Congress of Directors of the various Seed testing Stations was held in Moscow and it was definitely decided to follow the German regulation with certain minor additions, until the next sitting of the Congress.

Recently, the importance of examining seed by methods similar to those adopted by Western Europe has been given prominence, and the Commission of Agriculture has prepared a special order concerning the compulsory testing of seed quality. This order, after a final revision will be presented for consideration to the Council of Commissioners, and once this is established, seed testing will be working under more favourable conditions.

Prof. Dr. B. ISSATCHENKO,
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Southern Russia : Ukraine.

The Kharkoff Seed Testing Station was established in 1906, the writer of the present report becoming its Head in 1918.

In 1921, at the Seed Control Congress held in Kieff, this Station was recognised as the Chief Control Station for the Ukraine, both because the seat of Government was then at Kharkoff, and because this station was the best developed and the oldest in the Ukraine.

The present programme, which is the result of gradual and extended effort, is briefly described below.

I. *Examination and Testing of Seeds :*

(*a*) In the laboratory, from the point of view of germination, purity, weight, etc. :

(*b*) In the field, to determine the nature and variety of samples sown therein.

II. *Scientific Work and Methods.* — The present state of this branch of the station is so inadequate, that improvement in this direction has become urgently necessary.

III. *Testing for the Public.* — It should be the Station's duty to do work outside its own walls, and with an ambition to influence the seed question in an adequate and preponderating manner. The station and various seed growers and distributors have arrived at an understanding in the matter, in regard to sealing the sacks of seed and inspecting depots.

IV. *Propaganda Work.* — This part of the programme needs a great deal of attention. Cultivators in this country have not, as yet, properly grasped the importance of seed control. Interest must be awakened by the help of the press, of conferences, exhibitions, and so on.

V. *Staff.* — This consists of the Head of the Station ; 3 heads of sections ; two specialists ; 4 women analysts ; 3 practical workers ; one laboratory assistant ; secretary ; 2 servants. Temporary field workers are hired when wanted.

VI. *Laboratory Work.* — Without counting tests for scientific purposes, the following is the number of tests made between 1907 and 1923, viz : —

1907	899	1916	2521
1908	966	1917	1502
1909	1035	1918	605
1910	1930	1919	1613
1911	2540	1920	1698
1912	3557	1921	2290
1913	3778	1922	1417
1914	1932	1923	2084
1915	2708		

The maximum number of tests made was in 1913, as shown above.

Post-war events had an even greater influence than the War on the falling off of these figures, and in 1918, the station only tested 605 samples. Figures improved gradually from 1919.

The table of figures given below (for 1913, 1920 and 1923) shows the varieties of seeds dealt with by the Station.

	1913	1920	1923
Cereals and leguminous plants	25%	6%	46%
Forage plants	38%	15%	10%
Vegetables	16%	43%	29%
Cucurbitacae	9%	18%	3%
Oil Seed plants	4%	2%	2%
Flowers	2%	—	—
Sugar Beet	—	14%	9%
Various	6%	2%	1%

It will be noted that the proportion of cereals and legumes was only 6 % in 1920, which was due to the law of the Monopoly of Cereals. The State then owned and distributed seed by its Commissioner of Supply, and made its own analyses.

The year 1923 reflects with a fair amount of accurancy the state of the seed market. These figures may be different in the future as our seed market has not yet had time to settle down.

Our seed testing methods are founded on the " Regulations of the Union of German Experimental Stations ", followed by all Russian seed control stations (Decree of 1913).

VII. *Method of obtaining average sample.* — Limit for sample, taking 100 sacks. If the number submitted is over 100, the surplus is divided into parts and a portion taken from each. Mdme. WEKSLERCHIK (Head of Laboratory Section) has devised the following formula, viz.

$$K = 10 + \frac{S - 10}{5}$$

K is the required number of sacks from which seeds are taken ;
S is the number of sacks in the bulk.

When a sample is taken to discover the homogeneity of seed submitted for test, separate handfuls are taken from the bottom of the sacks and carefully examined. These are only mixed together after their similarity has been visually established.

If great dissimilarity occurs, a fresh quantity must be taken out, and, if need be, each sack examined separately.

VIII. *Passing samples through laboratory.* — We follow 6 fundamental rules in this regard, i. e. :—

(1) *Anonymity of samples,* which are only known to our assistants by their numbers.

(2) *Examination of all samples by head of section.* No sample can be tested without having been previously marked by the head of section — this avoids complications, and is also useful for experimental and other purposes.

(3) *Specialisation in laboratories.* Two of our 4 laboratories carry out germination tests ; the remaining two test for purity, weight, etc.

(4) *Parallel tests made by different persons.* This is a very strictly enforced rule, for mistakes can easily be made in mass analysis. Impartiality of analysis is also guaranteed in this way.

(5) *Card system.* Descriptions given on separate cards are collated by the Head on general cards. The latter are then used for making various groupings and for revising the station statistics. An important item for information is the quality of seeds tested in various years.

We give the following interesting figures as to the proportion of samples, sent in year by year, in which the germinative power was considered too low, viz :—

From	1907	to	1917,	percentage	of	samples	rejected	was	23.14%
»	1917	»	1918	»	»	»	»	»	29.35%
»	1918	»	1919	»	»	»	»	»	37.74%
»	1919	»	1920	»	»	»	»	»	37.98%
»	1920	»	1921	»	»	»	»	»	40.92%
»	1921	»	1922	»	»	»	»	»	33.26%
»	1922	»	1923	»	»	»	»	»	31.72%

It will be seen that, up to 1922, the quality of the seeds fell considerably, but that improvement took place in 1922 and 1923.

It should be pointed out that at present our station tests not only for germination power, but for germination energy. We con-

sider HEINRICH's method ("Landw. Versuchstationen", 1917) preferable to that employed by HILTNER.

(6) *Field testing section.* — Sporadic field investigation for purity began as far back as 1911, but routine work in this section only started, in 1921. For the last three years, the number of samples tested was as follows:

for 1921	500 samples
» 1922	300 »
» 1923	1574 »

In 1923 we tested not only local seeds, but those sent in by the best-known foreign firms to Moscow, whence the samples were forwarded to us. Their description is as follows:—

Root Crops	297 samples
Solanaceae	283 »
Cucurbitaceae	95 »
Brassicae	68 »
Leguminoseae	245 »
Other varieties	95 »
Local samples.	473 »

As a whole, the proportion of purity of the foreign seeds was high, but some of these samples were not satisfactory.

There were also high-quality samples among the local ones.

In order to carry out items, III, IV and V of its programme, our station has come to a " control agreement " with the All-Ukrainian Society for Seed Cultivation, members of our staff being entitled to call at grain depots and take away samples, visit exhibitions, and so on.

Notwithstanding the important nature of all this work, we have been unable to obtain a large number of results. We trust, however, that the latter will be more satisfactory when the special Seed Control Law is passed.

IX. *Question of General Interest.*

(1) *Seed Standards.* — As the quality of seed depends absolutely on local conditions of climate and soil, seed standards should also be local and should be set differently for various districts, being based on a large number of seed tests made from local samples.

Up to the present, the literature on the subject has not been of much assistance. The works best known to us are those of KOMMERS (Vienna) and GARBOWSKY (Warsaw) but these do not solve the general question.

In judging the quality of seeds, most control stations work on the arithmetical average of the greatest number of samples tested. This method sheds no light on what *standard* this quality should attain. In this respect, striking an average is of no use to the cultivator, seeds with a germinative power of 10, or 20 per cent., being of no value.

To elucidate the matter more clearly, let is take certain special cases. For example, the germination tests with 543 samples of *Pisum sativa* made from 1907-1917 which show the wide variations liable to occur.

TABLE I.

Classes . . .	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Percentage of germination	100	95	90	85	80	75	70	65	60	55	50	45	40	35	30	25	20	15	10	5	0
Number of samples . .	373	81	39	19	10	4	0	3	3	0	2	2	0	1	0	0	1	1	3	0	
Ratio %. .	68.82	14.95	7.20	3.51	1.85	0.74	0	0.55	0.55	0	0.37	0.37	0	0.18	0	0	0.18	0.18	0.55	0	

TABLE II.

Classes . . .	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Percentage of germination	100	95	90	85	80	75	70	65	60	55	50	45	40	35	30	25	20	15	10	0	0
Number of samples . .	87	47	46	22	11	9	9	3	11	4	2	1	7	5	4	3	2	2	3	5	
Ratio %. .	30.74	16.61	16.25	7.77	3.89	3.18	3.18	1.06	3.89	1.41	0.71	0.35	2.47	1.77	1.41	1.06	0.71	0.71	1.06	1.77	

It will be noticed that a regular decrease exists as far as the sixth class, but after this come irregularities. This is more definitely shown in the following curve.

The important signification of the term "standard deviation" should not be overlooked. For peas this is estimated at ± 4.9 %. Thus the germination percentages is given as :— average 95 % and minimum 90 % and under normal conditions the seeds on the market showing a lower percentage than 90 % should be given particular attention.

A further example is given with 283 samples of *Cucurbita* sp. and their germination capacity.

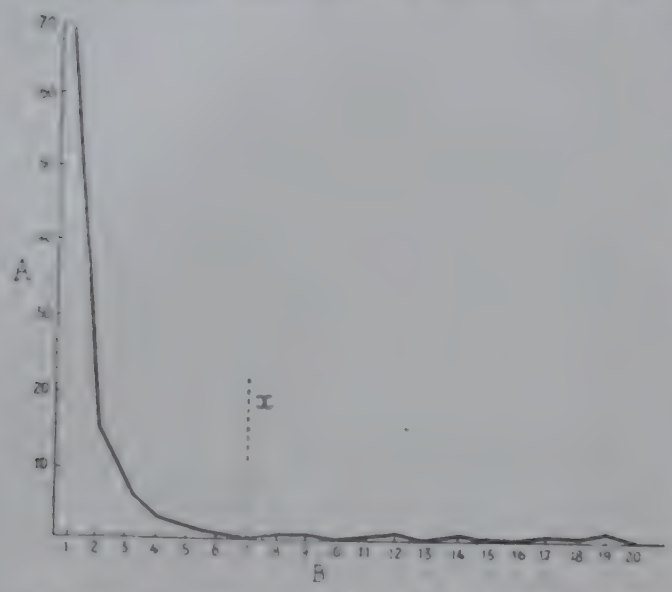

FIG. 114. — Classification of 543 samples of *Pisum sativum* for germination capacity.
A = Number of samples tested; B = Classes;
x = Line of demarcation.

In this case according to the curve, the decrease is regular up till the 8th class and is then followed by irregularities.

The average germination % is estimated as 91.9 %, minimum 81.0 %.

(2) *How to detect adulteration in the seeds of Brassicae.*

In the years between 1918 and 1921, these seeds were the dearest, one *poud* (40 Russian *pounds*) being worth as much as 500 *pouds* of wheat.

This naturally gave rise to a great deal of fraud, and A. M. EGOROFF at our station detected several methods of adulteration, all difficult to discover.

After reading SCHRODER, HARZ, and KONIG on the subject, EGOROFF succeeded in making a detailed microscopic examination of the structure of the membrane of these seeds and devised a method of microscopical analysis to determine the genuineness or adulteration of test samples of the seeds of Brassicae.

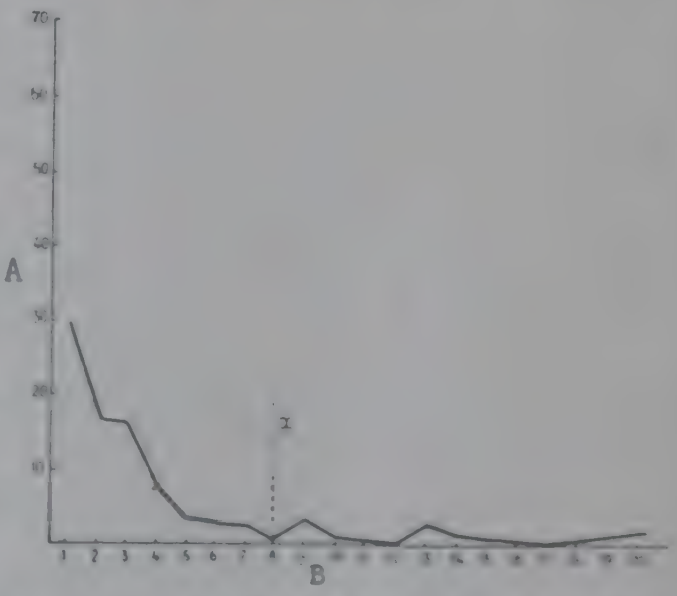

FIG. 115. — Classification of 257 samples of *Cucurbita* for germination capacity.
A = Number of samples tested; B = Classes;
x = line of demarcation.

(3) *Laboratory methods of distinguishing between summer and winter wheat.*

In the autumn of 1922, we were asked if our station had any special method of determining, by the appearance of the seeds, whether a parcel of wheat belonged to the summer or to the winter variety.

We were, of course, able to reply that it would be possible to determine, by the general quality of the seeds, if a given parcel was *Triticum durum*, which we cultivate exclusively for summer wheat. The winter wheat cultivated in our country is exclusively *Triticum vulgare*. The latter can often be distinguished from *Trit. durum* by the appearance of the seeds.

By determining the nature of the parcel of wheat (as belonging to *Trit. durum*), we simultaneously decided the question as to whether it would be used for spring sowing.

The question of *Trit. vulgare* is more complicated as both its winter and summer varieties are cultivated in this country. We are able to state that, without sowing it, it would be impossible to say whether a sample of *Trit. vulgare* belonged to the autumn or spring variety. The literature on the subject, however, gives some signs by which a distinction can be drawn between the seedlings of the autumn and the spring varieties. GOVOROFF (Petrograd, 1923) for instance, refers to the development of the second and third leaves as an absolute biological indication in autumn and winter wheat.

In autumn wheat, the osmotic pressure in the leaves is always greater than in the spring variety (DEUTSCH and KOLKOUNOFF, Kieff, 1914).

In our experiments under this head in November 1922 we sowed wheat in boxes filled with earth and placed on window-sills. We took 100 seeds each of ten absolutely pure varieties of autumn wheat, and the same number of spring wheat, all *Trit. vulgare*

When we began to take samples of the shoots to determine the osmotic pressure, we found that the seedlings of autumn wheat were of a bright emerald-green colour, whilst those of the spring wheat were of a very marked greyish-green shade.

Closer examination shewed the existence of a hairy growth on the leaves of the spring wheat.

After a number of experiments, we established the fact that spring wheat (*Trit. vulgare*) is, in our district, characterised by a hairy growth appearing on the first leaf sprouted. This growth is absent, or very much less developed, in autumn wheat.

This growth, of course, is not universal, depending greatly on the provenance of each sample. We cannot, as yet, say with certainty what are its regional limits, but we have noted its absence in some samples of Turkestan wheat and in the well known "Marquis" and "Kitchener" varieties of Canadian wheat.

When testing, our method of procedure is as follows:—

One thousand seeds are counted at random, when any seeds of *Trit. durum* can be distinguished visually, if present. From the remainder are taken two portions of 100 seeds, which are sown on a flat dish filled with soil. In from 6 to 7 days the first leaf pierces the coleoptile, and the best time for observing is when it has grown to a height of from 1 to 2 centimetres from the latter. Observations can be made with the naked eye, or, better still, with an ordinary magnifying glass.

We use this test method at our station, when making analyses for which fees are paid.

(4) *Laboratory methods of distinguishing between different varieties of barley.*

Hordeum distichum and *Hordeum tetrastichum* are the varieties with which we are most familiar, *Hordeum hexatischum* being very rarely met with, except in Turkestan and Finland.

Owing to the different formation of the ears, it is easy to distinguish between the two kinds of barley. *H. tetrastichum* has seeds of two kinds, (*a*) those which are quite symmetrical, and (*b*) those in which one side is more developed than the other, its entire formation being crooked. In books by SCHINDLER, HOFFMANN and FLANSBERGER, illustrations show this peculiarity plainly. The relation between asymmetrical and symmetrical seeds in the ear is 66 % : 33 %, or 2 : 1.

As the asymmetrical seeds are smaller and lighter than the others, they come away more easily during sorting and cleaning. Thus their proportion in cleaned grain is taken as being 60 : 40.

This allows us to determine, not only whether a given sample belongs to or one another variety of barley, but whether it is, or is not, a mixture of *H. distichum* and *H. tetrastichum*. For instance, in a 10 gramme sample of barley there were only 183 seeds, out of which 120 were symmetrical and 63 not. Therefore:

$$183 : 120 \text{ (asymmetric} :: 100 : x$$

$$\text{therefore } x = \frac{120 \times 100}{183} = 65.6\%$$

As pure barley (*H. tetrasticum*) should not contain more than 40 % of symmetrical seeds, if we find 65.6 %, this means that the barley is mixed with *H. distichum* in the proportion of 65.6 — 40 = 25.6 %.

We deduce that the sample is a mixture of *H. tetrastichum* and *H. distichum* and that the latter has been introduced in the proportion of 25.6 %.

In conclusion, the list of our publications should explain to the reader the nature of further questions now occupying the attention of our Seed Control Station, but to which we cannot refer within the pages of the present Report.

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ABNORMAL GERMINATION OF MUSTARD SEED AND. FOOD VALUE OF MUSTARD-SEED CAKE.

In 1910, the Consul-General of Calcutta sent to the Berlin Agricultural Control Station (*Landwirtschaftliche Kontrollstation*) a sample of East Indian Sarson described as " Lal Sarson seed ", which, since it was identical in external appearance with the coarsely-granular brown seed of *Lalka Tora* (1) as described by me, was put aside for future use and labelled Brown Sarson. In May of this present year, while engaged in drawing up a comparative seed table of species of mustard and rape that are very difficult to distinguish apart, I found that I had run short of Brown Sarson seed and wrote to Berlin requesting that some should be forwarded to me. This led Dr. FILTER to examine the seed that had been kept so long at the Control Station under the name of Sarson and he found that some mistake had been made, for the supposed Sarson seed had a pitted epidermis. The subsequent investigation of the seed here in Munich, together with the examination of the plants raised from it, confirmed my suspicion that we had to do with a variety of Sarepta-mustard grown in East-India. The sample proved very uniform and contained only about 1 % of foreign seeds, the smaller, deeply-pitted, and darker-brown seeds of Indian mustard (*Br. juncea* H. fil and Th.). During the War, when examining stock-feeding cakes from South India, in company with Dr. FILTER, I had pointed out the presence of a light-coloured Sarepta-mustard on very many occasions. Sometimes, these cakes were entirely composed of this light-brown Sarepta seed; as a rule however, they contained a mixture of real yellow Sarson mixed with the light-brown variety (2). After this discovery, it was not surprising that in course of time, the coarsely-granular brown-seeded Sarepta-mustard from South India found its way

(1) *Die Landwirtschaftlichen Versuchsstationen* 1889, p. 178.

(2) KINZEL, Mikroskopische Futtermittelkontrolle. E. Ulmer, Stuttgart, p. 93.

more and more into Bengal, where at the time I wrote my paper, no Sarepta-mustard was yet cultivated. In fact, many brown Sarepta-mustard cakes that come from Eastern India contain a greater, or less, admixture of other Indian varieties of *Brassica*. The Sarepta-mustard seed is light-brown, being similar in colour and size to the coarsely-granular, brown Sarson seed, or to the somewhat more coarsely granular seed of *B. dichotoma*. Only by careful examination with a lens can it be seen that the surface of some of the seeds is distinctly pitted, although the greater number are almost smooth and thus are exactly like Brown Sarson seeds.

The sample of Brown Sarson seed that had become dry after lying for 14 years in a room kept at ordinary temperature, retained its viability in a marvellous manner. On being placed on a suitable bed (burnt-out brick refuse), 25 % of the seeds germinated normally after 3 days, 34 % after 8 days and 62 % after 20 days. In addition, there were some abnormal seedlings, while the rest had probably damped off. According to DEMOUSSY (1), better germination could certainly have been obtained if the oxygen supply had been increased by the use of hydrogen-peroxide. The results are however sufficiently striking if compared with those reported by DORPH-PETERSEN (2), for in his experiments with 2 samples of rape seed only 1 % germinated in the 13th year, while only 1 % of the seeds of one out of two samples of wild turnip seed kept till the 15th year proved viable (after 13 years, 7 and 4 % germinated). In these cases again, the samples were small and had been kept at a temperature of 18°C. It should be observed in passing that the Danish Seed Control Station, which does so much to further the interest of the wholesale seed trade, is also intending to carry out experiments for the purpose of determining how long the different commercial seeds can retain their germination capacity, when kept in large quantities under ordinary trade conditions. Seeds of the spurious Brown Sarepta sown at Berlin at the same time as seeds of the true Russian Sarepta-mustard, produced plants with leaves so different in shape from the type form, as to make it probable that we have here to do with a small-seeded Sarepta-mustard, coming originally from continental Central Asia, but which has been cultivated for centuries in South India.

(1) KINZEL Frost und Licht als beeinflussende Kräfte der Samenkeimung. Nachtrag II. Verlag. E. ULMER, Stuttgart, p. 140.

(2) *International Review of the Science and Practice of Agriculture*, No. 2, April-June 1924, p. 282.

In order to obtain still further confirmation of this hypothesis, seeds from the 14 year-old sample have been grown recently both in Munich and in Bozen, (1) with the hope of getting more ripe seeds of this remarkable mustard.

In any case, this variety, like all other Indian varieties of *Brassica*, is of great economic importance, not only as the source of table-mustard, fatty mustard oil and etherised mustard oil, but also as supplying cakes used for stock feed. As has been lately shown, dealers are still doubtful whether it is permissible to sell compressed cakes of Indian mustard under the name of "rape-cake". A Bavarian landowner recently received 5000 kg. of so-called rape-cake which contained an extraordinary amount of mustard oil and was not made from the waste of European rape and wild turnip seeds, as required by the Association of Agricultural Experiment Stations of Germany ("Verband der landwirtschaftlichen Versuchstationen im Deutschen Reich"), but was composed exclusively of the waste of Indian species (chiefly *B. juncea* and *Sarson*), containing a high percentage of mustard-oil. The landowner stated that his cattle refused to eat these cakes, even after they had been steamed for a long time. Cakes with such a large percentage of oil can be employed in the same manner as White Mustard (*Sinapis alba*) cakes, which were used during the War as a flavouring in certain cases, when the basal ration is unpalatable and a fair amount can be given, but they should never be put on the market and sold to the customer as ordinary European rape-cakes, which possess entirely different properties. In Leaflet No. 40 of the Bavarian Institute of Agriculture and Plant Protection (*Landesanstalt für Pflanzenbau und Pflanzenschutz*) which was published in March 1921 and entitled "Farmer, Buy and Use only Tested Stock-Feeds" ("*Landwirte kauft und verfuttert nur untersuchte Futtermittel*"), further information is given on the subject of these so-called "Indian rape cakes" which are always called by the Institute "Indian Mustard-cakes" in order to avoid any confusion. In any case, the qualification "Indian" should never be omitted so that the farmers may avoid using them where they would do harm, for instance as a feed for a cow in calf.

In conclusion, mention should be made than the sample of

(1) Cultivation experiments at Bozen have confirmed the view respecting the damages in plants due to southern climatic conditions (Author's note).

Indian Sarepta mustard (as we must now call it), which retained its germinating capacity for 14 years, has thrown some light upon a mistake made in all the literature describing the structure of the testa of the true Indian mustard (*B. juncea* H. fil et Th.). Even the seeds of the Indian rape (Tori, *B. dichotoma*) have been erroneously stated by many authors (1) to possess multicellular mucilage cells.

It now appears very possible that the seeds examined were really the seeds of this Indian Sarepta-mustard, a plant which was originally cultivated only in Southern India.

It must not be forgotten that the extraordinary long time this Sarepta-mustard (*B. Besseriana* Andr.) retained its germinating capacity may certainly to be attributed to the difference between the climates of Bengal and Germany. PRAIN informed me that the only way in which the peasants of Bengal can preserve the viability of their mustard seed from one rainy season to another, is by hanging it up in the chimney, otherwise the damp heat of the tropical climate kills the seed before the end of the year. If we consider how greatly such climatic conditions must necessarily alter the properties of the seed (producing a higher fat content and a different type of protein and enzyme), we shall readily understand that in a relatively cold climate, like that of Germany, the Sarepta-mustard seed would certainly retain its viability for a much longer time than German-grown rape or mustard seed.

Further, a fact that is now well-known to all seed-merchants must be borne in mind, that seeds brought from a colder climate, especially from countries with low atmospheric pressure, *very quickly* lose their viability in warmer places where the carbon dioxide pressure is greater. For this reason, wholesale dealers in the seeds of Alpine plants (many ornamental species grown in gardens), never sell seed which has been kept over the first winter. The seeds of all varieties of gentian, especially, must be gathered when the weather is very cold and dry, if they are to retain vitality until the second year.

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(1) See KINZEL, Mikroskopische Futtermittelkontrolle. E. ULMER Stuttgart. (Burchard and Collin and Perrot).

FORESTRY RESEARCH IN BELGIUM.

Scientific sylviculture is based on observation of natural phenomena and since the study of Nature receives stimulus and assistance mainly from experimentation, scientific research should be instituted and developed in all places where it is necessary to encourage forestry and increase its utility. Belgium is a very densely populated country with extensive industries, but before the War, it possessed a wooded area of only 17.7 %, which was capable of little or no extension. The forests supplied only about one quarter of the timber required, the rest having to be imported. Therefore, the aims of forestry policy were clearly to preserve the existing woods, produce the maximum quantities of timber to supply the general needs of the nation by turning to account all uncultivated land, as well as to improve the forests by judicious management, use wood in a reasonable and economic manner, and protect the forest ranges from danger of destruction.

Organisation of Foresty Experiments. — As a result of the impetus from abroad, Belgium founded an Experiment Station in 1896. A Service of Research and Advice on Forestry was created by the Administration of Waters and Forests and placed under the jurisdiction of the Ministry of Agriculture. The work began in a very modest manner, the staff at first being limited to an Inspector of Central Management at Brussels, who with the help of one assistant, laid out experiment plots in the State nurseries of Groenendael, Brussels and other parts of the country.

Except in the case of the Groenendael nurseries, the task of laying out the experiment plots and registering the results according to special instructions, devolved upon the foresty agents and the heads of the Cantons. For many reasons, this system could not be as satisfactory as the creation of Stations where the research work was the exclusive occupation of an expert staff.

The Belgian Service became affiliated to the International Union

of Foresty Research and is represented at the various Congresses held by that Union. It had the honour of making all the arrangements connected with the Sixth Congress, which took place in Belgium in 1910. This was the last meeting of the Federation, for its work was interrupted by the outbreak of the War.

In 1919, the special Service of Scientific Forestry Experiments and Advice (the name borne at the time), was given a new Statute more suitable to its mission. It became autonomous, although still connected with the Administration of Waters and Forests. The Service had its headquarters at Groenendael, where the Management of the nurseries, of an extensive arboretum and a museum, represented a considerable part of its activities. The staff included an Inspector, who was Head of the Service, a general assistant and ranger and a brigadier, who acted as clerk. This Service was required to lay out and measure the experiment plots, as well as to report upon all the results obtained.

Its duties further included :

1) Experiments of different kinds (which will be dealt with later on), carried out in the forests under forestry service management and on the uncultivated land of different districts of Belgium.

2) Experiments on plant production, especially in the Groenendael nurseries. The objects of these experiments were : to provide foreign trees for the arboreta, experiment fields and State forests (although any surplus stock might be sold to Communes, or to private individuals), and to supply foreign species, such as the English oak, that are difficult to obtain through ordinary commercial channels and are of great practical importance.

3) The creation and up-keep of arboreta in the forest-regions of the country. The institution of enquiries regarding the exotic trees growing in Belgium.

4) The collection and purchase of seeds of native and foreign forest trees with a view to their sale to Communes and private individuals. The analysis and testing of seeds grown or purchased, by the Service.

5) Giving scientific advice, usually to private owners, of wooded estates.

6) The maintenance of a public forestry museum at Groenendael.

A small Research Station was instituted in 1920 at Gembloux, by the Chair of Foresty Economy of the State Agricultural Institute.

This Station is attached to the Groenendael Experiment Service and is chiefly engaged in laboratory experiments, including the study of forest-tree seeds collected in Belgium, and in seed analysis and testing.

In 1922, a Supervision Commission was instituted in connection with the Experiment Service. The Commission will draw up each year the programme of research to be started, or continued, in the arboreta and the forests and to take the necessary measures for the publication of the results obtained.

The work of the Experiment Service is extended not only to making actual studies, but also to the popularisation and propagation of progressive methods. The Service keeps in touch with the Belgian foresters by informing them of its work and also by organising visits to the nurseries, arboreta and experiment fields.

Belgian forestry experimentation as at present officially established, is far from having the breadth of scope and the means at disposal that distinguish certain foreign organisations. Improvement is necessary in several respects in order that it may be placed in a position to solve the numerous problems that still demand consideration. Since, however, attention has been directed to practical objects, some praiseworthy work of considerable importance for sylviculture has already been accomplished.

Mention must also be made of the experiment work due to the initiative of the forestry agents and of private owners, especially as regards foreign trees, and the afforestation of waste land. Many very useful results have already been obtained.

Programme of Experiments and the Results recorded. — A minute analysis cannot be made in a few pages, of the work that is being accomplished by the Experiment Service. A general summary only can be given showing its relations to the conditions and requirements of our country and based upon the information published in the *Bulletin de la Société centrale forestière de Belgique*.

The investigations are especially concentrated upon questions relating to the planting, replanting and restoration of forests. This is the field which has hitherto yielded the most fruitful results.

Many experiment plots have had to be more or less neglected and a certain number were destroyed during the German occupation of Belgium.

Judicious choice of Trees. — Our forest flora is relatively poor in valuable species of trees ; thus for instance, none of the large conifers

are represented, although Belgium, in spite of its limited area, affords very varied conditions both of soil and climate. Hence, it is necessary to seek among foreign flora for trees that will flourish and furnish the products, especially saw-timber, necessary to supply the needs of the country.

Numerous foreign species of conifers and broad-leaved trees have been successfully cultivated for a long time. The former include *Pinus sylvestris*, *P. maritima*, the black Austrian pine, common spruce, and the European larch, while the deciduous trees are represented by the Canadian poplar, red American oak, the false acacia (*Robinia*), chestnut, etc. but fresh efforts must be made in this direction.

For this purpose, the Experiment Service has instituted a large number of arboreta of which there are already 24 scattered throughout the forestry districts of the country, the oldest and most extensive being at Groenendael. The first trees of this arboretum were planted in 1898, and it now covers about 13 hectares and contains about 350 forest trees, in addition to more than 200 species of shrubs.

Tervueren-lez-Bruxelles also has a very interesting arboretum, instituted on the initiative of the late King Leopold II and managed by M. Bommer, Conservator of the State Botanic Garden.

There are also many parks in Belgium where foreign trees are well represented. In addition, some private land owners have made as an experiment, large plantations of different exotic species.

The Experiment Service is engaged in the second stage of the study of foreign trees and has introduced into large plots, and under true forestry conditions, those species that have shown certain valuable qualities in the regional arboreta.

All this material provides a valuable service of information and of practical experience. *Pseudotsuga Douglasii*, *Pinus Laricio*, *Larix leptolepis* and *Prunus sclerotina* are beginning to be numerous in the plantations. Other species, such as *Chamaecyparis*, *Lawsoniana*, *Thuya gigantea* and *Abies grandis*, which have been studied for a shorter time, appear very promising. Many foreign trees already bear fruit in Belgium and produce fertile seed.

As was said above, the Experiment Service at Groenendael raises the foreign trees for the arboreta and forests, this being part of the experimental programme. In 1901, the Minister of Agriculture ordered a general enquiry, both as to the definitive results obtained by the acclimatisation experiments that have been in progress in Belgium for more than a century, and the experiments to be made for the

purpose of increasing the number of trees to be introduced. This work was entrusted to the Superior Forest Council, which appointed a Special Commission that drew up an exhaustive report (1).

Judicious choice of Forest Seeds. — The experiments of Cieslar, in Austria, attracted attention to the practical importance of the origin of forest seeds. The question was of great interest to Belgium, especially as regards *Pinus sylvestris*, since this tree is widely used for planting on waste ground and for the restoration of forests that have fallen into a bad condition. Further, a large number of *Pinus sylvestris* seeds are collected in the lower part of the country, especially in Campine. Only a very small and insufficient quantity of this home-grown seed was used in Belgium, the rest being exported, while the deficit was made up by seed purchased abroad. For this reason, it was necessary to ascertain what seed succeeded best in Belgium.

In order to decide the question, the Experiment Service organised several series of experiment plots, starting from 1902, in the whole of Lower and Central Belgium for the purpose of instituting a systematic study of the growth of *Pinus sylvestris* of different origins, both Belgian and foreign. It also took part in the international experiment on the same subject, executed by the Union of Research Stations.

So far, it has been found from all these experiments that the *Pinus sylvestris* raised from native seeds is superior to any other. The same conclusion has been reached in other countries, for experiment has proved that local races or varieties, do best in any given region.

The seeds of *P. sylvestris* that are put on the market, are collected in Campine from stunted trees and before they are completely ripe. Experiments have been carried out to determine how far the value of the seeds is affected by these circumstances. Hitherto, little or no difference has been detected between plants grown from well-shaped, or from stunted, trees. Gathering the seed before it is quite ripe tends to lessen the germinative power to a certain extent, but does not appear to affect the plants, except perhaps when they are very young.

These experiments are still in progress and no definitive results can be expected until later.

Numerous experiments have, however, proved the excellent germinating capacity of seeds of *P. sylvestris* produced in Belgium.

It has also frequently been observed that the seeds of many foreign

(1) Comte Amédée Visart and Charles Bommer. *Rapport de l'introduction des essences exotiques en Belgique*, Brussels, 1909.

species such as Douglas pine, *P. maritima*, Corsican larch, and black Austrian pine, for instance, when gathered in Belgium, produce trees that are more vigorous and resistant to the climatic conditions than seeds bought in their country of origin.

The Experiment Service is now turning to practical account the results obtained from its researches. In order to use on State property seeds which have the highest germinating capacity and are of authentic origin, and also with a view to setting an example to forest owners, this Service has the seeds of the various trees collected every year in Belgium, and prepares them in a small drying establishment which it possesses at Groenendael. Seed that cannot be prepared by the Service itself are purchased, their price being fixed as far as possible according to their cultural value. The testing, or analysis, of seeds that have been prepared or bought, is carried out at the Station laboratory. Communes, or private individuals can purchase seeds through the Experiment Service.

Many experiments have been made on the conservation of seeds, especially acorns and beech-nuts, that easily lose their germinating power and also on the preservation of other seeds such as those of pines, spruce, etc., of which the supply exceeds the annual demand. The best results as regards the first type of seeds have been obtained by mixing them with sand and storing them in a silo in the open air, but protected from rodents. The second type of seeds keep best in hermetically closed vessels, placed in a cold room.

Plant production. — The Experiment Service since its foundation has conducted innumerable experiments in the Groenendael nurseries with a view to discovering the best means of raising plants, whether from seed, by planting out, layering, taking cuttings, planting cover-crops, providing shelters, root-cutting, the use of fertilisers, etc.

In the same nurseries are propagated, chiefly for the benefit of the State forests, native species that can only be found with difficulty if at all, on the market (rare plants, or those of absolutely authentic origin, or of a local type).

Afforestation of uncultivated lands, or those denuded of trees by felling. — Belgium has made and is still making a vigorous effort to turn to account waste land, owing to the necessity of purchasing from abroad most of the cereals needed for bread-making and much of the wood required. As a rule, the less good soils that are unsuited for agriculture, and the extensive *landes* of the Campine are those chiefly planted with trees. These sandy soils are, however, very infertile

and only poor results are obtained unless they are adequately prepared.

The woods and stands of Campine have been greatly improved as a result of very numerous and varied experiments, the first of which were made by certain private individuals. The Forestry agents on their own initiative, and particularly the Special Service, organised a very large number of systematic experiments on trees, different methods of manuring, ploughing, draining, afforestation, etc. The State has purchased two stretches of waste land, one at Exel covering an area of 450 hectares, and the other at Raevels (800 hectares), which are being used for numerous afforestation experiments. These two estates are valuable and important for the sylviculture of Campine.

In 1905 a Commission was appointed by the Minister of Agriculture to make a general study of Campine from the forestry standpoint (1). After a thorough examination of the district, the Commission drew up a voluminous report (1), in which are stated the rules that have now become classic, for afforestation and the management of stands. Thus, the soil should first be prepared by a through ploughing at least to a moderate depth, and must be manured with chemical fertilisers (especially basic slag, kainit and sometimes lime) ; in certain cases, a green manure (lupin), has been regularly employed with excellent results. The experiment work has also been carried out on an extensive scale in Campine with a view to making further improvements. The fields where experiments were being carried out on draining and manuring, before afforestation in the case of the peat-moors of the higher part of the country, have been destroyed by fires.

The Experiment Service has other questions also to examine such as the protection to be given to some plants against climatic factors (the white alder and the broom have proved efficient shelters respectively, for the beech on uncropped land and the spruce). Another problem engaging attention is the different ways of mixing trees ; group association has given the best results, although close intermingling is more suited in the case of trees with light foliage and rapid growth like the larch, which thrives best when grown in association with shade species).

Forest planting and management. — The experiments made in forest management are chiefly directed to the formation of sub-stages in copses and high woods of conifers, working the soil to assist natural

(1) *Rapport de la Commission chargée de l'étude de la Campine au point de vue forestier.* Brussels, 1905.

generation in beech-woods, the lopping of conifers, and making clearings in the forests of tall trees (the investigations are carried out to ascertain the influence, different forms and intensities of these operations).

Further, there are a considerable number of plots for the study of tall forest production and the formation of copses under tall trees.

The work on clearings and the formation of stands has not yet given results of practical importance, although it extends over a long period. Many series of plots had to be abandoned on account of the German occupation of Belgium; finally, the small staff at the Station has not yet succeeded in reorganising, methodically, the cubage of stands, which is the basis of experiments of this type.

Conditions of working and utilisation of Woods. — The Experiment Service has made some studies on the conditions of working bark copses (times and methods of exploitation), the conservation of woods (effect of certain antiseptic agents), and stump extraction. To this Service is due the introduction of the first mechanical stump-extractor into Belgium. This machine aroused the ingenuity of our mechanics ; there are now several types of stump extractors both in this country and abroad that are employed with excellent results.

Forest Protection. — An experiment on clearing the soil covering is still in progress.

The Experiment Service is engaged in practical work on the control of parasites invading nurseries or forests, but as regards measures involving a deeper knowledge of fungi and insects, the assistance of experts is obtained from the Gembloux Official Phytopathological and Entomological Stations, the Botanic Gardens and the Natural History Museum.

* * *

Such are the broad lines of the organisation and work of the Forestry Experimentation Service in Belgium. Although the Service may appear insignificant as compared with many similar institutions abroad, it has been especially successful in securing practical results.

It is to be hoped that, in spite of the depleted condition of the public funds, the Experiment Service will be able to extend its activities still further, for the future belongs to those nations that strive by means of research to introduce progressive methods of production.

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THE PROBLEM OF INCREASING PRODUCTION IN FISHPONDS BY THE USE OF CHEMICAL FERTILISERS

The use of chemical fertilisers for the purpose of increasing fish production in ponds appears to have been tried many years ago, but the results of the experiments have not been published. It is, however, hardly likely that greater success was obtained by these purely empirical attempts than that which attended the work carried out at the Bavarian Pond Fishery Experiment Station Station (*Bayrischen teichwirtschaftliche Versuchsanstalt*) from 1912-1918, after the whole question had been scientifically investigated. In order to ascertain the effect of the fertiliser when thrown into the pond, it is necessary to acquire deeper insight into the cycle of events than can be obtained from field experiments; further, the truth of the statement that fish production in water also obeys the law of the minimum must be worked out from experimental results. It is not possible to deal here with the whole problem of the artificial manuring of fishponds which has been the subject of a limited amount of literature. A bibliography is given at the end of this article, therefore the reader will be referred to the works therein mentioned and remarks will be confined to the most salient points of the problem.

It may perhaps seem surprising for me to preface these observations with the statement that, more definite information can be obtained by the scientific method of investigating the chemical fertiliser problem than from field experiments under similar conditions. This is mainly due to the fact that production is chiefly affected by the substances dissolved in the water and that this solution is not subjected to such changes in concentration as the soil solution upon which field plants depend. Water analysis being easier and more rapid that soil analysis, gives a clearer and more rapid insight into the available nutrient substances than can be gained by soil analysis.

In the first place, the fertilisers which can equally well be ta-

corporated into the soil or thrown directly into the pond, are only of importance in the cycle, in so far as they are soluble in water. The mass action of water plays such a large part in the matter that substances which are generally classed as insoluble in water, such as ground basic slag, " Rhenaniaphosphat ", bone-meal, etc., must be considered as possessing a factor of solubility. As regards production in the pond, it is of paramount importance to known how the component parts of the system, viz. the soil, water and added fertiliser, interact.

No single method of carrying out this research has so far been devised. In laboratories equipped with the necessary apparatus described by MITSCHERLICH in his " Bodenkunde " (second edition), it is advised that a given amount of soil should be taken, together with some of the water of the pond after the introduction of the fertiliser and the mixture stirred for a certain time. The following has been taken as the fertiliser unit : 10 mgm. water-soluble P_2O_5 and 10 mgm. water-soluble K_2O per 1 litre of water. When there was no means of stirring the compound, 200 gm. of naturally moist soil was shaken with 1400 cc. of water to which the fertiliser had been added, and at the end of exactly 24 hours the solution was separated from the soil by means of porous cells and an aspirator. The substances affording nutrition to plants are present in the solution in the same quantities as they would be met with in the manured pond-water after one day had elapsed. The method entails difficulty in the taking of samples from the water-saturated pond-bottom, but air-dried pond soil cannot be used as it is not in the natural condition. In numerous experiments with the most different types of soil from the bottom of ponds, the absorption figures for P_2O_5 ranged from 13.8 % to 100.0 % ; only in one single case, was the P_2O_5 removed from the soil by water containing humic acid. I have observed the same phenomenon, however, in the case of a pond containing similar water, from which soil was taken.

The absorption in the case of the K_2O was entirely different, for the absorption percentage varied from 0 % to 50.6 %, and the K_2O was frequently removed from the soil of the pond bottom by the action of the water. These low figures are especially noticeable when the water flowing into the pond is highly calcareous.

Among the circumstances regulating the requirements of the pond must be reckoned the greater solubility of the K_2O in the pond soil, as compared with the P_2O_5, although pond-productivity depends

on the supply of a larger amount of P_2O_5 than of K_2O. In order better to understand this fact, let us examine the average K_2O and P_2O_5 content of natural waters. According to VON RABEN (1), the water of the North Sea contains between 0.069 mgm. and 0.151 mgm. P_2O_5 per litre. BELOHNBECK says the P_2O_5 content of river water ranges from 0.69 mgm. - 0.10 mgm., but when the water is contaminated, these figures are naturally much higher. In the case of lake and pond water, of which it is difficult to find any accurate analyses, I have myself collected data resulting from a large number of experiments (4) which show that 1 litre of this water nearly always contains less than 0.1 mgm. P_2O_5. At periods when the water is greatly contaminated with organic matter, and when water containing humic acid is acting upon the bottom of the lake, or pond, much higher figures can be found *temporarily*; thus, in one instance, as much as 2.6 mgm. P_2O_5 per litre were present.

This amount may be compared with the potassium content which is always higher than that of the phosphoric acid. The minimum amount is 0.08 mgm., but generally 1 to 2 mgm., and on several occasions, as much as 10-20 mgm. of K_2O were present per litre of water. The ratio of P_2O_5 to K_2O is about 0.03 : 1, if exceptional figures are not taken into account. On comparison of the amount of the three nutritive substances N, P and K required by the pond, we get according to ALEXANDER, HAEMPEL and NEHRESHEIMER (2) the following figures for the dry substance needed by the plankton of an experiment pond : 8-10 % N., 1.1-1.2 % P_2O_5 and 0.4 % K_2O. WALTER gives the amounts in the case of the plankton of a village pond as 9.1 % N., 3.5 % P_2O_5 and 4.5 % K_2O. This latter plankton was evidently richer in plant forms. If we consider the dry substance composition of pond fish, we find this given by KNANTHE and CRONHEIM (3) as 5.48 - 11.84 % N., 3.08-8.43 % P_2O_5 and 0.15-1.04 % K_2O (for carp and tench). This proves that for fish production in a pond, about 10 times more P_2O_5 than K_2O is necessary, while the water contains about 30 times more K_2O than P_2O_5. All these statements lead us irrevocably to the conclusion that scarcely even the minimum quantity of P_2O_5 can find its way into the pond.

In our subsequent investigations, only P_2O_5 and N. have to be

(1) *Wissenschaftliche Meeresuntersuchungen*. Kiel, 1905. Vol. 8.
(2) *Die Fischerei als Nebentrieb des Landwirts und Forstmannes*.
(3) *Zeitschrift für Fischerei*, Berlin, 193.

considered ; these substances, which are most necessary for production, generally occur only in small quantities in the water of ponds and therefore must usually be regarded as minimum factors among the nutritive substances present.

Sea-water and fresh-water both contain 1 mgm. of nitrogen per litre, although this figure may be considerably exceeded during unusual periods or when the water is much contaminated by organic matter. Therefore as regards N., the food-value of natural waters is more satisfactory than as regards P_2O_5, even if we allow that organic production requires from twice to three times as much N. as P_2O_5. It is further conceivable that the N. can be obtained (at all events in a proportionally minimum amount), that is to say, after satisfying the P_2O_5 minimum by means of the application of a fertiliser containng sufficient P_2O_5, a N. minimum arises. Such cases have actually been observed and will more readily occur the poorer the pond-soil is in lime or albuminous matter, or in the elements entering into the composition of the latter. This is my explanation of the manurial experiment with $(NH_4)_2$, SO_4 at the former Pond Fishery Experiment Station (*Teichwirtschaftlichen Versuchsanstalt*) of Sachsenhausen-Oranienburg in Mark Brandenburg. The sandy soil of that district is very poor in lime, so that there can be no question of any display of great activity on the part of nitrogen-fixing bacteria in the pond. We now come to the question of the importance of nitrogen-fixing bacteria from the point of view of the yield of the pond. The discovery of their activity had an historical course of which the chief points should here be briefly stated. At first, it was supposed that great attention should be paid to the introduction of nitrogen in the manuring of pounds. Experiments carried out without any scientific basis were believed to have proved the great efficiency of saltpetre applied as a fertiliser to ponds. The results obtained by Hofer (5) at the above mentioned Pond-fishery Experiment Station proved saltpetre to have no effect upon ponds. Negative results distinguished the experiments made at the Sachsenhausen-Oranienburg (8, 9) Experiment Station on quite different soils and in which the most delicate methods were adopted for detecting saltpetre in pond-water only a few days after the application of the fertiliser. Since saltpetre is not absorbed by the soil, it must have been removed from the water by some other means. I was successful in showing (4 *f*), that when the pond bottom is formed of calcareous soil, and the water contains organic matter and is raised to a high temperature,

the activity of the denitrifying bacteria is so great that the saltpetre disappears in a short time, while none of its nitrogen is returned to the atmosphere. An $(NH_4)_2 SO_4$ fertiliser also, is eventually denitrified by means of the devious path of nitrification, but it can be used by the pond flora during this transformation process. This is the reason of the success obtained at Sachsenhausen-Oranienburg with an $(NH_4)_2 SO_4$ fertiliser and subsequently with calcium cyanamide. In Wielenbach, there was evidently more than the N-minimum originally present in the pond, for the fertiliser introduced produced scarcely any perceptible effect. Since, however, the nitrogen of the soil and the water is being constantly removed by pond-organisms, this easily-calculated loss of nitrogen can in the end be demonstrated by analysis. The nitrogen demand cannot be satisfied by any affluent water that can reach the pond, or by rain alone, since in the first place the nitrate which is transported there is also subjected to denitrification. The same result follows in the case of the soil nitrogen, which is quickly changed to nitrate by the strong nitrification property of the calcareous soil which is rich in lime ; this loss of nitrogen could also be easily proved by soil-analysis. In fact, as a result of the flooding of a former meadow-ground, the nitrogen percentage of the soil fell the first year from an average of 0.80 % to nearly the half (average 0.48 %). In the following years, the nitrogen content of the pond soil rose considerably, for in the second year it had already reached the average of 0.53 % in the unmanured pond, and of 0.67 % in the ponds manured with superphosphate, while at the present day, the Wielenback pond-bottom is reckoned as one of the soils richest in nitrogen. Thus, in spite of the continued removal of the nitrogen by the increase of inhabitants of the pond, the soil did not become poorer, but richer in nitrogen. In this case again, I was fortunate enough to discover the cause of the curious phenomenon (4 *a*, *c*, *d*) which is also to be attributed to the activity of the water bacteria that extract the nitrogen from the air and transform it into albumin. The presence of these nitrogen-fixing bacteria in both fresh and saltwater has been shown by the researches of REINKE, KEDING and KENTER. The *Azotobacter chroococcum* isolated by these scientists from water, or from water-plants, does not, however, do much work in ponds. Indeed, in the counts of water and soil bacteria growing on culture plates, it was seldom met with and only appeared when mannite was added to the culture solution. The following nitrogen-fixing forms were on the other hand found regularly

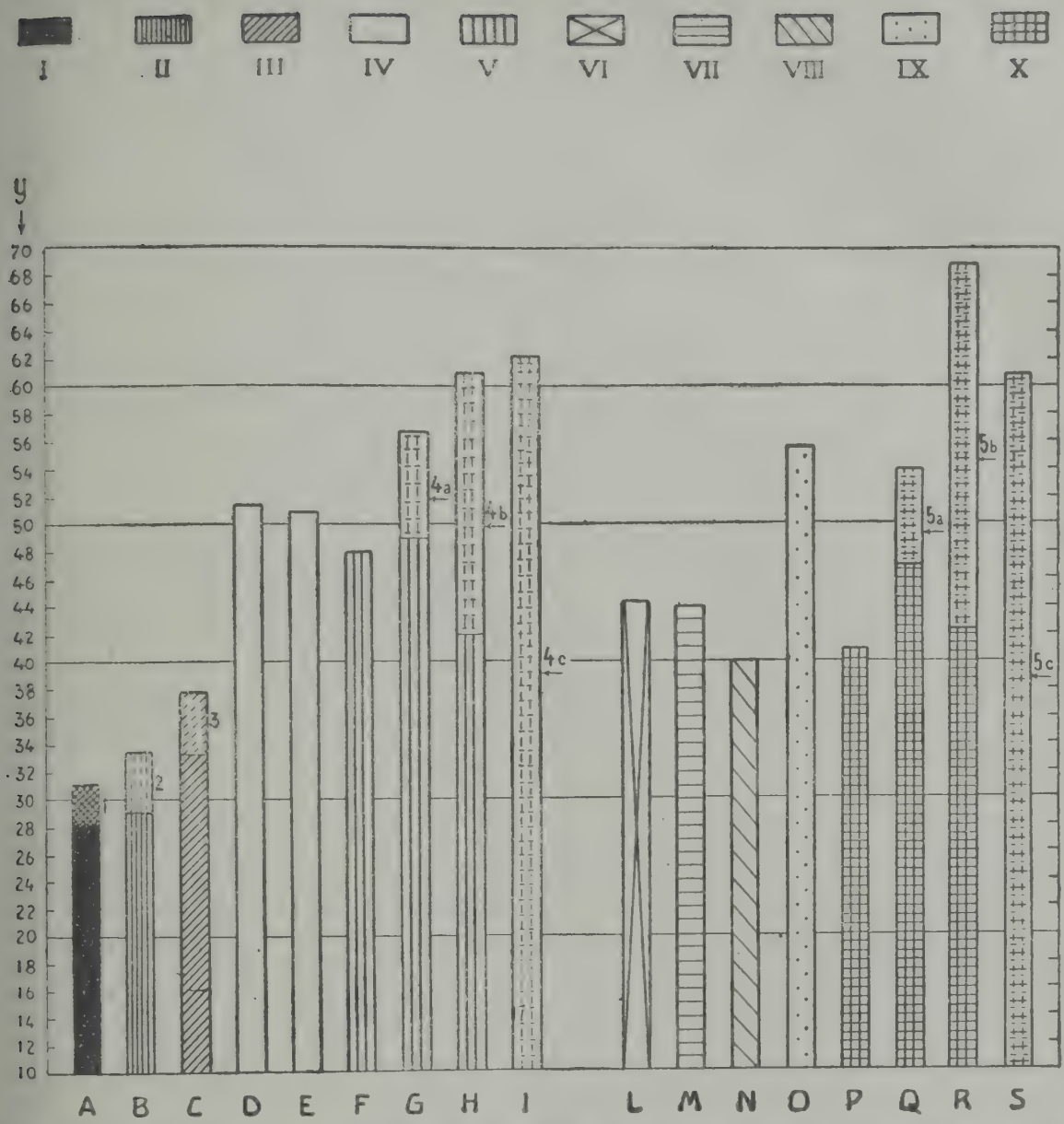

FIG. 116. — Ordinate (y) = increase in live weight of fishes in kg. per pool from 0 to 70 kg. Abscissae = Types of fertiliser.

I = Without fertiliser shown on the abscissa as A = shaded part I, increase obtained in 1915.

II = Addition of 50 kg. of potash salts at rate of 42 % per pool, shown as B; shaded portion 2= increase in 1915.

III = 10 quintals of straw shown as C; shaded portion 3 = increase in 1915.

IV = Superphosphate 130 kg. per pool shown as D; and 60 kg. as E.

V = Superphosphate potash salts, F = 30 kg., G = 60 kg.; H = 90 kg.; I = 120 kg. per pool.; 4a, 4b, 4c = increase in 1915.

VI = Superphosphate 60 kg potash salts 25 kg. L = silicon humate.

VII = Superphosphate 60 kg, potash salts 30 kg.; M = sodium humate.

VIII = Basic Slag 90 kg. — potash salts indicated by N.

IX = Superphosphate 90 kg. potash salts + 5 quintals sewage residue indicated by O.

X = Superphosphate + potash salts + carbohydrate (sewage sludge, brewers grains, reed compost) indicated by P (30 kg. superphosphate, potash salts, sewage sludge, 1915; reed compost; 1916; shaded portion 5 a shows increase in 1915; R = 90 kg. superphosphate + potash salts + sewage sludge 1915; reed compost, 1916; 5b = increase in 1915; S = 120 superphosphate + sewage sludge; 5c = increase in 1915.

and in large numbers: *Bacillus asterosporus* A. M. and Brei., *Bac. danicus*, Löhn., *Bact. aerobacter* Beij., *Bact. turcosum* Löhn., *Bact. radiobacter* Beij. The fact that no nitrogen minimum need be apprehended, at all events under the conditions of soil and water obtaining at Wielenbach, is to be attributed to these energetic collectors of nitrogen.

There still remains the questions of the importance of phosphoric acid for pond productivity. This substance as has been shown, occurs in exceedingly small quantities in all natural waters, for although this statement referred to a single phosphorus-minimum obtained from a pond, it is confirmed by the results of all the scientific pond-manuring experiments that have yet been made. The last of these experiments, which was carried out in 1923 at Wielenbach, by E. WALTER proved that even in trout-ponds with a stream flowing through them, the introduction of a phosphoric acid fertiliser raised the P_2O_5 content which had previously been the minimum. The increase in the fish of the pond keeps pace with the rise in the P_2O_5 content of the pond-water, as is graphically shown by the results of the Wielenbach experiments.

There only remains to be considered the data of the two experiment years as set out in the tabular summary. The figures prove in the first place that the increase in fish weight is greater in warm than in cold years; the difference being more marked in manured ponds. This shows that the manure is turned to better account in warm years, or in other words, the phosphoric acid-minimum is not so quickly removed by the heat-minimum.

The increased yield in unmanured carp and tench ponds varies from 28 to 31 kg. per 2000 m^2 of bottom surface area multiplied by, on an average, 0.5 m. of water-depth (viz. in a volume of water amounting to 1000 m^3). The apparent increase in yield (29.0-33.5 kg.) resulting from the introduction of only 40 % potassium salts, falls within the limit of experimental error.

The liberal application of stable manure had but little effect (33.1-37.8 kg.), because a single application does not introduce enough soluble phosphoric acid into the water. Immediate and striking results were observed wherever ground basic slag or superphosphate were used. An increased yield of 50.9-51.8 kg. was obtained from the introduction of pure superphosphate. The addition of potassic salts did not increase the yield (48.1 kg.), but 50.9 kg. increased yield was given by superphosphate without any admixture of potassic

salts. The apparent rise in productivity in the case of progressive amounts of superphosphate manure (60,90, 120 kg.), and of potassic salts falls within the limits of experimental error as far as the potassic salts are concerned, for real increase in yield only occurred when larger amounts of P_2O_5 were introduced. Siliceous humate and sodium humate from which much was expected owing to the presence of nitrifying bacteria, had no effect beyond apparently lessening the activity of the superphosphate. Manuring with ground basic slag increased the yield 40 kg. Ground basic slag, owing to its lower water solubility, has less effect than the same amount of superphosphate. When the pond has an acid soil, ground basic slag is, however, very efficient and is particularly recommended on account of its property of neutralising acids. Organic substances, such as mud from precipitating tanks, molasses, waste cellulose, wood paper refuse and reed-compost, in association with superphosphate can temporarily increase production (in 1916, the maximum increase obtained with superphosphate + reed-compost was 68.8 kg.). This is explained by the fact that nitrogen-bacteria not only need phosphoric acid, but like saprophytes, are dependent on organic matter as a source of energy. This organic matter is, however, so copiously supplied by the plant plankton of old ponds that the addition of any organic matter to the fertiliser is in their case wholly superflonus.

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AGRICULTURAL INTELLIGENCE

AGRONOMY

Soil Science.

842. **A Statistical Study of the Distribution of Soil Material in the United States according to the Size of Its Particles.**

JENNINGS, D. S. (Utah Agricultural Experiment Station), *Soil Science*, Vol. XVII, No. 6, pp. 469-485, figs. 5, bibliography. Baltimore, Md., 1924.

A comparison of given types of soil from various regions cannot give an accurate idea of the quantitative distribution of the materials composing them, for every kind of soil is made up of particles of diffferent size. If the area occupied by a given type of soil is multiplied by the percentages obtained by mechanical analysis of the various separates, the result is the areas of the separates. If this is repeated with each soil class and the areas of like separates summed, the total area represented by the various classes will then be reduced to the areas of the separates.

The area, when divided by the total area of all the types, will then give the ratios of the areas of the different separates to the total area. The statistical method is then applied to the total area by means of the formulae of the average square of deviation, or index of variability (method of least squares).

The author examined the composition of thirteen of the chief divisions of soils in the United States. These soils consist of coarse sand, sand, fine sand, sandy loam, fine sandy loams, loams, silt loams, clay loams, clay. For the mechanical analysis, he used a scale of seven types arranged according to the decreasing diameter of the separates expressed in mm. from Nos. 1 to 7. The scale is as follows 2.1, 0.5, 0.25, 0.1, 0.05, 0.005 The lowest limit for clay is fixed at 0.0005 mm. The method of analysis adopted was that of JENNINGS, THOMAS and GARDENER (*Soil Science*, Vol. XIV, p. 88).

The results obtained show that, in the case of the soils examined, the proportion of the area of separate 5 to the total area is approximately constant. Expressed in terms of percentage, this ratio is 14.32 ± 0.39. For small areas the deviations and probable errors are lower for

separate 5 than for separates 4, 6, 7, whereas the coefficient variability is lower in separate 5 than in any other separate except 1. An examination of the graphic curves when the diameters of the various separates are plotted as abscissae and the logarithmic values of the corresponding percentages plotted as the ordinates, reveals several interesting facts. In the first place, it is seen that in sandy soils, separate 5 is found at the lower limit, while in soils of compact texture, it occurs on the upper limit. The curves tend to assume the form of an *S* and in the soils intermediate between the two just mentioned, separate 5 lies between the regions of maximum curvature. Quartz-bearing, igneous rocks, tend to give soils low in silt and high in sand and clay; soils derived from mixtures of sandstone and shale approximate to the average texture, and limestone, slate, shale, and loess material tend to give soils of high silt and low sand content. The "general mean", which probably represents the average soil class of the United States, is a loam.

A. F.

843. Erosion and Surface Run-Off under Different Soil Conditions.

DULEY, F. L. and MILLER, N. F. *University of Missouri, Agricultural Experiment Station, Research Bulletin* No. 63, pp. 1-50 figs. 22, bibliography. Columbia, Missouri, 1923.

The superficial erosion of the soil by rain produces a considerable deterioration in the quality of the land, although the losses sustained are greater or less, according to the nature of the soil and the character of the crop.

With a view to determining the extent of this loss, some experiments have been made in which the great differences between various soils have been taken into account. These experiments are of a new type, since hitherto only the losses of water-soluble suibstances that can be removed by leaching have been considered.

The experiments described in the Bulletn were undertaken for the purpose of estimating accurately the amount of the erosion caused by surface run-off in the case of soils that are differently worked and cropped. The experiments were carried out for a period of six years, and the amount of the erosion was estimated in seven plots that had been worked and cultivated in a different manner.

Each plot of $^1/_8$ acre was of an elongated shape and had an average slope of 3.68 %. In order to collect the water and the sediment contained in it, wells were made at the end of each plot.

The plots of ground were treated as follows :

1) Left uncultivated, all weeds removed, and the soil levelled.

2) Ploughed to a depth of 4 inches in the spring ;

3) Ploughed to a depth of 8 inches in the spring ;

4) Cultivated as permanent pasture ;

5) Ploughed in July to a depth of 8 inches and sown every year with wheat.

6) Soil ploughed to a depth of 8 inches before sowing. Rotation of maize, wheat and clover.

7) Sown every year with maize, ploughed in spring to depth of 8 inches.

The amount of water lost from every plot was estimated from the depth of the water that fell on the plot each time it rained. The quantity was found to be different on the various plots during the same year. The tables give the measurements for each of the 7 plots during each of the 6 years of the experiment.

The periods of the greatest run-off, and hence of the maximum erosion, were found to be March and April, and August and September. The plots most affected were Nos. 2, 3, 4, and 6 ; more than half the total erosion took place in the above months.

The loss from erosion was greatest on the uncropped soil that had been ploughed. When the ploughing was carried to the depth of 4 inches, the maximum losses occurred, but the loss was less than 13.40 % when the soil was ploughed 8 inches deep. This proves that although deep ploughing reduces losses by erosion, its effect in this direction is less than might have been supposed. The losses are considerably less on land that has been both ploughed and cropped.

In the case of deeply ploughed land under maize, the losses were 50 % less than in that of ploughed, but uncropped, land. Wheat reduces the losses 81 % and rotations 93 %.

The meadow-land lost 0.68 % as compared with the uncropped land ploughed to the depth of 4 inches.

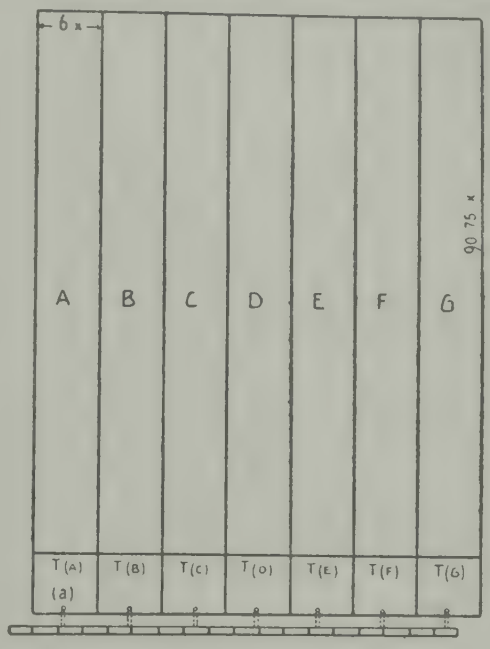


FIG. 117. — Diagram showing arrangement of parts and the placing of the wells.
A = Uncultivated and weeds pulled ;
B = Ploughed 4 inches in spring ; fallowed ;
C = Ploughed 8 inches in spring ; fallowed ;
D = Continuous sod ;
E = Wheat ploughed annually 8 inches in July ;
F = Rotation : maize, wheat, clover ; ploughed 8 inches before maize ;
G = maize annually, ploughed 8 inches in spring.

The erosion was evidently proportionate to the number of heavy rainfalls in the year. In the case studied, more than 50 % of the total erosion in 5 out of the 7 plots, occurred after 16 of the heaviest rainstorms that had taken place during the 6 years.

Chemical analyses have shown that the amount of nitrogen, phosphorus, lime and sulphur lost through erosion by a soil under maize or wheat, can equal or exceed, that used by the crop. It is worthy of remark that the amount of nitrates lost is but small.

Mechanical analyses demonstrated that the material removed from uncropped, or cropped, soil contained a high percentage of sand and a low

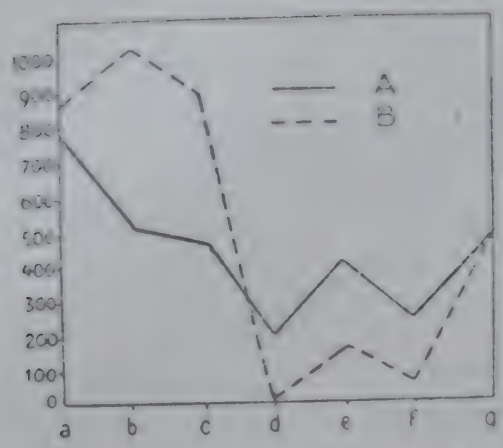


FIG. 118. — Average annual amount of run off and weight of eroded material from each plot. Note the smaller proportion of soil carried by the water from the cropped plots. Run off cub. ft. Erosion pounds.
a = bare ; b = ploughed 4 inches ; c = ploughed 8 inches ; d = sod ; e = wheat ; f = rotation ; g = maize ; —— run off ; - - - - erosion.

percentage of valuable material as compared with the material removed from the plots.

In estimating the value of these experiments, it is necessary to take into account the fact that they were confined to a given type of soil in a special region. Some of the conclusions are however of a general character ; thus for instance, deep ploughing has proved to have little effect in reducing erosion losses, and it has been established that the amount of water absorbed by given soils remains almost always the same, no matter how great may be the variations in the rainfall.

We may conclude by stating that wheat-growers should reduce the run-off, which has such a detrimental erosive effect, by selecting a rotation of crops that will insure the ground being covered as long as possible with vegetation. Clovers and forage gramineae are eminently suited for this purpose.

A. C. M.

844. Effect of Ignition at Various Temperatures upon certain Physical Properties of Soils.

BOUYOUCOS, G. J. (Michigan Agricultural Experiment Station). *Soil Science*, Vol. XVII, No. 2, pp. 135-139, bibliography of 2 works. Baltimore, 1924.

The author has studied the effect of heating many soils of various characters to different degrees of temperature. The objects of his work was to ascertain at what temperature the physical properties of the soil begin to be appreciably altered and also the temperature at which the reaction ceases. In this study, three characteristic properties of soils are taken into account, capacity of giving out heat of hydration — the content of combined water — their plasticity.

When the soils were heated to temperatures below 230°C. no perceptible changes took place, but small alterations were observable after 230°C., the three above-named properties were much reduced and at 800°C. they generally disappeared

After heating to 800°C. no soil however finely divided is capable of giving out any heat of hydration.

This effect was especially noticeable in the case of soils of the colloidal type.

The author, having drawn attention to the fact that even the ash of soils rich in organic substances and containing much clay, gives out no

heat of hydration even when very finely divided, states that the results obtained from his experiments will provide a basis for a new method of determining the colloidal content of a soil. L. M.

845. **Some Physical Properties of Transvaal Soils.**

MARCHAND, Dr. B. de C. *The Journal of Agricultural Science*, Vol.XIV, Part II, pp. 151-169. Cambridge, 1924.

The author investigates in the first place the relations between the clay content of soil and hygroscopic water and loss on ignition.

The soils of the Transvaal contain rather a low percentage of organic matter and the losses on ignition are largely due to the water of hydration and volatile matter. In the case of 88 samples of soil, a close relation was found between the clay percentage, amount of hygroscopic moisture and the losses on ignition; this relation may be expressed graphically as follows. (See fig. 119)

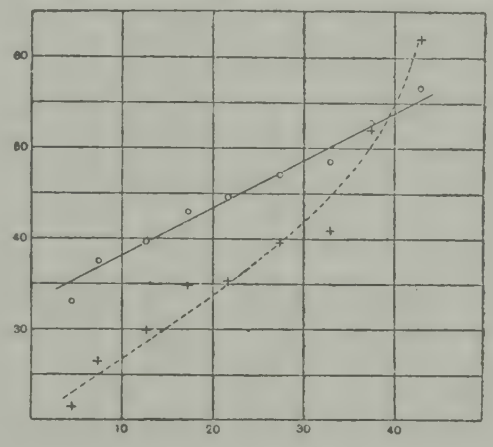


FIG. 119. — Clay %.
x = moisture plus loss on ignition;
o = loss on ignition; x = moisture.

The points plotted were obtained by averaging (*a*) the percentage of clay falling within the groups 0-5 %, 5-10 % etc., and (*b*) hygroscopic water and loss on ignition for soils having more or less the same clay content.

It would appear that the variations in the hygroscopic water plus the losses on ignition can be represented by a straight line and that from these variations a factor can be obtained from which it is possible to calculate approximately the clay content if the percentages of hycroscopic moisture and the ignition losses are known. This factor is approximately 2.5. Naturally, there are exceptions to this general rule and these exceptions may be of two kinds. In the first place, the soil may be rich in organic matter and in the second, they may contain a large amount of ferruginous matter in which cases higher percentages for clay with be found by mechanical analysis than one would suppose them to contain. It should be noted that the curves showing respectively the moisture content and the ignition losses give a definite idea of the general course of the variations and of the existing relation.

The method adopted by the author for determining the water-holding capacity and the pore space of the soil is a modification of that of KEEN and RACZKOWSKI.

The results obtained from 48 samples, all taken from different types of soil which are of importance in the Transvaal, are given in the following graph and refer to soils containing less than 5 % of clay, 5 to 10 % and so on.

The increase in pore space with the increase of the amount of clay present is well shown by a straight line, while the increase in the absorp-

tion capacity with the increase in the percentage of clay is perhaps better represented by a curve. (See fig. 120).

If p gms. of soil absorb q gms. of water

$$\text{Water capacity} = \frac{q}{p} \times 100,$$

$$\text{and pore space} = \frac{q}{q + \frac{p}{\text{sp. gr.}}} \times 100$$

In many works on the physical qualities of soils, pore space is defined as the space between the soil particles which is filled by air ad water. In dry soils, it may be expressed as follows.

$$\frac{\text{true specific gravity} - \text{apparent specific gravity}}{\text{true specific gravity.}} \times 100.$$

The definition of pore space must be modified according to the method adopted for its determination. In the KEEN and RACZKOWSKI method, pore space is the space occupied by the water, in water-saturated soil. This qualification is important. The author examines the difference in the results obtained by the various methods adopted in the experiments and explains why he chose to follow the KEEN and RACZKOWSKI method in his determination of the pore space, water capacity, true and apparent specific gravity and volume expansion of the soil.

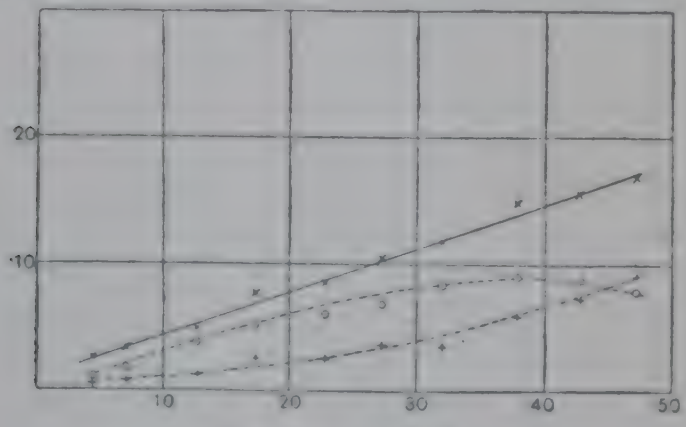


FIG. 120. — Clay %.
o = pore space ; x = water capacity.

It is shown that all these properties may approximately be referred to the percentage of clay in the soil, but the relations are not sufficiently accurate to be used practically in determinations.

It would appear that comparison of all soils, without discrimination, on the basis of mechanical composition, would lead to utterly erroneous conclusions. The chief value of mechanical analysis is for purposes of genetic classification as ROBINSON has shown. This is particularly true in the case of the Transvaal soils, which are as a rule sedentary and where large expanses of alluvial soil are unknown.

A. C. M.

846. **The Replacement of Soil Potassium (1).**

VANDECAVEYE, S. C. *Soil Science*, Vol. XVII, No 1, pp. 91-96, bibliography Baltimore, Md., U. S. A., 1924.

The author's experiments on the determination of replaceable potassium in sterile and non-sterile Carrington loam, treated with applications of clover hay and manure, may be summarised as follows :

1) About 90 % of the absorbed potassium of the loam was replaced by two extractions with normal NH_4 Cl.

2) The application of organic matter, such as clover hay and manure, resulted in the liberation of replaceable potassium from the soil. The amount liberated was proportional to the amount of organic matter applied.

3) The clover hay effected the liberation of replaceable potassium in a greater degree than the manure.

4) The CO_2 production and biological activity showed no relation to the liberation of potassium.

5) Sterilization had no effect on the replaceable potassium, but the sterilized soils, due probably to the effect of the decomposition products resulting from the application of heat and pressure to the moist organic matter, liberated more potassium than the unsterilized soils.

6) The liberation of replaceable potassium appeared to be largely a chemical process which seemed to proceed in the absence of biological factors. W. S. G.

847. **The Ammonifying Power of Agricultural Soil.**

PEROTTI, R. and AURELI, F. Sul potere ammonizzante del terreno agrario. *Atti della R. Accademia Nazionale dei Lincei*, Vol. XXXIII, No. 10, pp. 405-40. Rome, 1924.

The object of the authors' experiments was to demonstrate the difference in the ammonifying power of agricultural soils as shown by the solution method.

The investigations so far carried out were made with reference to :

1) the different nature of the soils ;
2) the different seasons of the year ;
3) the state of cultivation of the soils.

The following is a summary of the method adopted. 10 cc. of a 1.5 % solution of WITTES' peptone are placed in several test-tubes and sterilised, after which they are inoculated with equal weights of water and of the soil to be examined. The samples thus treated are cultivated (in quadruple) at 20-25°C. for four days, at the end of which time, the ammoniacal nitrogen produced is determined.

The results obtained showed that perceptible differences exist between the ammonifying powers of cropped agricultural soils. The exact differences still remain to be determined, although it may be stated that normal soils

(1) See *R.* 1924, No. 584. (*Ed.*)

(i. e. those with alkaline reaction), can generally produce, as a result of aerobic-chemical processes, all the ammoniacal nitrogen required by crops.

A. C. M.

848. **Sunlight and Chemical Nitrification.**

ZOLCINSKI, J. *Roczniki Nauk Rolniczych*, Vol. X, Part 2, pp. 310-332. Poznan, 1924.

Chemical nitrification occurs in an ammoniacal solution of humic substances under the influence of the solar rays, but the nitrates thus formed disappear in darkness.

The conditions of the experiment (high ammonia concentration, presence of organic matter, very limited aeration, action of sunlight) would in any case exclude any biological action, even if it had not been rendered impossible by the addition of chloroform.

Chemical nitrification is accompanied by the decoloration of the humic substances.

This nitrification is more energetic and sets in sooner when quartz vessels instead of glass vessels are used and the dark brown humic matter then becomes straw-coloured.

Nitrification is hastened by hydroxide of aluminium. The process does not take place in the case of pseudo-solutions of ammonia, or in the presence of organic colloids.

The series of systematic experiments and observations of nitrification under natural conditions made at several Experiment Stations, have proved that chemical nitrification does actually take place.

R. D.

849. **Azotobacter in the Soils of Poland.**

ZIEMIECKA, J. Présence de l'azotobacter dans les sols polonais. *Roczniki Nauk Rolniczych*, Vol. X, Part 2, pp. 233-310, tables 17. Poznan, 1923.

The Institute of Industrial Fermentation and Agricultural Bacteriology at Warsaw analysed 28 Polish soils with the object of studying the development of azotobacter in relation to the different natural factors. The culture media (BEIJERINCK'S solutions), were inoculated with 10 % of soil and kept at 28°C.

Azotobacter was found to be present in 14 out of the 28 samples. The bacteria were especially numerous when the soil moisture fell below 5 %, and when the reaction was acid or neutral, and if the total nitrogen content rose above 0. 15 %.

The amount of atmospheric nitrogen fixed, increased with the moisture; it was higher in autumn than in spring and was augmented by the alkaline reaction of the soil, and by the percentage of $CaCO_3$, CaO, humus and phosphoric acid present.

The addition of sodium humate to the culture media stimulated the development of azotobacter and increased the amount of nitrogen fixed.

R. D.

850. **Methods for the Disintegration of Soil Aggregates and the Preparation of Soil Suspensions.**

WHITTLES, C. L. (School of Agriculture, Cambridge). *Journal of Agricultural Science*, Vol. XIV, Part 3, pp. 346-369, figs 6, tables 7. London, 1924.

As a result of recent advances in analytical methods the question of the preliminary treatment of a sample of soil has become of greater importance.

In an earlier paper the author described experiments which showed that a vibratory treatment of a soil suspension resulted in a disintegration of soil aggregates which had resisted the action of ordinary shaking.

An account is given of work which has been done on the Continent and elsewhere.

In the present paper an apparatus is described, designed to impart a known number of vibrations per minute to a suspension of soil. The calibration of the apparatus is briefly discussed.

A new method for the comparison of the mechanical composition of suspensions is given.

Various preliminary treatments of samples of soil for mechanical analysis are compared, and it is shown that :

(*a*) The rate of wetting of the sample is an important factor.

(*b*) A combination of trituration and vibration gives a satisfactory degree of dispertion.

(*c*) The use of acids is not advisable. W. S. G.

851. **Field Measurement of Soil Moisture.**

HARDY, Prof. F. (Imperial College of Tropical Agriculture). *Tropical Agriculture*, Vol. I, No. 7, pp. 98-100, tables 2. Trinidad, 1924.

In the study of the effect of environment on the growth of plants, it is difficult to show the exact relationship between soil moisture and crop yield. Rainfall data alone are not sufficient as a measure of the amount of water available for plant growth, because drainage and evaporation remove a variable quantity of water. Nor is a knowledge of the total moisture content of a soil sufficient, as different types of soil hold water with different degrees of tenacity, and a plant can never entirely deplete a soil of its moisture ; this is especially so in clay soils containing colloidal matter. The *rate* at which plant roots may draw upon the moisture depends upon the ease of transference of water in the soil, and this depends upon the permeability of the soil as decided mainly by texture.

In 1920, Dr. LIVINGSTON measured directly the water-supplying power of a soil by the employment of porous porcelain cones (soil points). The gain in weight of these points when pushed into the soil and allowed to remain there for a definite time, was taken as a measure of its water-supplying power. The method was developed by Dr. MASON, who used ordinary writing pencils as soil points, and obtained results which could be relied upon to measure water-supplying power.

The author applied MASON'S method to field problems, details of his

procedure having already been published (*Jrl. Agric. Science*, Vol. XII part 4, 1924). The investigations were carried out on a sugar estate in Antigua, but the method is of universal application. It was noted that the canes in certain fields suffered less from drought than those on others, and the difference had been assigned to differences in calcium carbonate content of the soils. The soil-point method showed that the water-supplying power of the more calcareous part of the estate was greater than other parts. No direct relationship was found between the total soil moisture and the water supplying power.

The conclusion was drawn that crop yields show fair positive correlation with water-supplying power of soil.

The differences that various crops exhibit as regards their water requirements at different stages of growth, and the response of the soil to these demands, may be demonstrated by the use of soil points. The method may also be applied to studies of the distribution of plants in different natural habitats and to the problem of root distribution in relation to soil conditions. W. S. G.

852. Estimation of Colloidal Material in Soils by Adsorption.

GILE, P. L., MIDDLETON, H. E., ROBINSON, W. O., FRY, W. H., and ANDERSEN, M. S. *United States Department of Agriculture, Bulletin* No. 1193, pp. 41, bibliography. Washington, D. C., 1924.

The non-colloidal soil constituents are defined in this paper as the distinctively mineral particles above 1 micron in diameter. The following are classified as colloidal constituents: all the organic matter the inorganic material dispersing into particles below 1 micron in diameter, and aggregates of particles less than 1 micron in diameter.

The earliest methods of determining the colloidal material in soils consisted in actually separating this material from the rest of the soil. The probable error in this method is the difficulty of obtaining a complete deflocculation, or peptisation, of the colloidal substances. This error is enormous in some rapid methods recently suggested. The adsorption methods previously proposed probably do not indicate in most cases even the relative colloidal contents of soils, since they do not include a determination of the adsorptive capacity of the kind of colloidal material present.

The adsorption method investigated in this paper (which was suggested by MOORE, FRY and MIDDLETON *Journal Indus. and Engin. Chem.* Vol. 13, No. 6, pp. 527-530) involves determinations of the adsorptive capacities both of the soil and of the colloidal material extracted from the soil. The ratio of the two adsorptive capacities $\left(\frac{\text{adsorption per gram soil}}{\text{adsorption per gram colloid}}\right)$ multiplied by 100 is taken as giving the percentage of colloidal material in the soil.

Tests of this method on 32 soils are reported, the percentages of colloidal material being calculated from the adsorptions of malachite-green, water and ammonia.

The colloidal materials extracted from different soils vary greatly in their adsorptive capacities for malachite-green and ammonia, but are much more constant in their adsorptive capacity for water In the case of 13 soils, the percentages of colloid calculated from the adsorptions of malachite-green, water and ammonia agree ; in the case of 14 soils the percentages indicated by the adsorptions of two of the substances agree, but disagree with the percentage indicated by the adsorption of the third substance In the case of 5 soils, different percentages of colloid are indicated by the adsorption of all the three substances.

The two most probable sources of error in the adsorption method of determining the colloid content of a soil appear to be : *a*) the difficulty of extracting a sample of colloidal material which is exactly representative in adsorptive capacity of all the colloidal material in the soil ; *b*) the possibility of a change taking place in the adsorptive capacity of the colloid as a result of extraction. These two possible sources of error are investigated in the case of several soils.

The adsorptive capacity of a small sample of extracted colloidal material differs by about 10 % from the adsorptive capacity of all the colloidal material that is extractable by the methods employed. However, the colloidal material that cannot be extracted has in many soils, a much lower adsorptive capacity than that which is extractable.

Evidence is presented which indicates that the colloidal material has a somewhat different adsorptive capacity after extraction than it has in untreated soil. The data indicate that the colloidal material of most soils in its extracted condition is slightly more adsorptive of malachite green, slightly less adsorptive of water-vapour and considerably less adsorptive of ammonia than before it was extracted.

The errors of sampling and of probable alteration of the colloidal material vary in magnitude in different soils. They are cumulative as a rule in the case of dye adsorption, but tend to balance each other in the case of water, or ammonia adsorption.

The authors checked the accuracy of the adsorption method by comparing, in the case of 6 soils, the quantities of colloid shown by this method with the quantities shown by gravimetric and microscopic methods. When the adsorption ratios are corrected for possible alteration in the absorptive capacity of the colloid produced by extraction, the percentages of colloidal material indicated by the adsorptions of malachite green, water and ammonia agree well in nearly all cases with the percentages of colloid determined gravimetrically and microscopically. When no such correction is made, the ratio obtained by the adsorption of water is in most cases more accurate than the dye, or ammonia ratio and approaches the true value closely.

It is pointed out that the wide discrepancy between the estimates of the colloid contents of soils given by various investigators is due in part to differences in definition of " soil colloids " and in part to faulty methods. The 32 soils selected for this investigation contained 6 to 7 % of colloidal material as defined in this paper, and even if soil colloids are definited to include only material dispersed into particles of sub-microscopic size, 2 % is obviously too low. L. M.

853. The Electrical Method for Determining Soil Alkali.

JOSEPH, A. F., MARTIN, F. J. and HANCOCK, J. S. (Wellcome Tropical Research Laboratories, Khartoum). *Cairo Scientific Journal*, Vol. XII, No. 115, pp. 141-143. Cairo, 1924.

In the investigations on soil alkalis carried out at Khartoum during recent years, the determinations of the amount of water-soluble salts have generally been made by the conductance method on account of its rapidity, a matter of importance when dealing with very large numbers of samples.

In 1914, BEAM and FREAK published a modified method for making electrical determinations, designed to distinguish calcium sulphate from the harmful alkali salts. This method indicated that in the Gezira soils the amount of gypsum considerably exceeded that of the toxic salts.

The investigations of the authors have shown, by actual analysis, that the sodium salts are in excess of the amount of gypsum and they are, in consequence, compelled to discard BEAM & FREAM'S method and the results obtained previously by its use. W. S. G.

854. Estimating the Nitrification Capacity of Agricultural Soil.

PEROTTI AND GRANDIS, G. Sopra la misura del potere di nitrificazione del terreno agrario. *Atti della R. Accademia Nazionale dei Lincei*, Vol. XXVIII, No. 10, p. 408-411. Rome, 1924.

The authors dscribe their experiments in determining the nitrification capacity of soil, carried out by the solution method as follows: 50 cc. of 2 ‰ aqueous solutions of ammonium sulphate and of potassium diphosphate were put into 100 cc. flasks together with 1 gm. of ground magnesium carbonate and enough pumice-stone to rise above the level of the solutions. Each flask was then inoculated with 1 gm. of the soil to be examined, and placed for 25 days in a thermostat at 20°-25°C. The estimate was based on the average of 4 analyses of each culture. The nitrates were determined on the filtrate of the culture solutions and the washings of the pumice-stone, a sulpho-carbolic reagent being employed. A. C. M.

855. Humus and Humification.

FALLOT, B. Humus et humification, sur une méthode de dosage de l'humus dans les terres. *Chimie et industrie*, Vol. II, No. 5, pp. 873-874. Paris, 1924.

The author, after laying stress upon the important part played by humus in determining fertility in arable soils, states that most of the methods used for estimating this substance are confined to discovering the amount present, whereas his method is based on the following considerations: 1) the bodies dissolved in potash are polysaccharids, viz., substances which are known as humus and for which is adopted the general formula $C_n(H_2O)_m$: 2) the total carbon content of these substances amounts to 50 %, so they may be regarded as having the formula $C_{18}H_{36}O_{18}$. This pseudo-molecule requires 2 × 18 atoms of O for its complete oxidation, that is to say, 215 gm. of organic matter need 288 gm. of oxygen to

oxidise them. Therefore, from the amount of oxygen liberated the quantity of carbon can be estimated, and hence the equivalent in organic matter calculated according to the above formula and the following statement: if 288 gm. of oxygen correspond to 108 gm. of carbon, 8 gm. of oxygen will be equivalent to 3 gm. of organic carbon, or $3 \times 2 = 6$ gm. of organic substance. Thus the authors' method, just like the quantitative analyses of the organic matter in water, consists in determining the amount of permanganate of potassium required for oxidation and in estimating the equivalent amount of carbon, or organic matter. A. C. M.

856. **A Note on the Colorimetric Estimation of Humic Matter in Mineral Soils.** *l*

EDEN, T. (Rothamsted Experimental Station). *Journal of Agricultura Science*, Vol. XIV, Part 3, pp. 469-472. London, 1924.

ODÉN has shown that colour intensity comparisons can be made between alkali exracts of peat soils of varying origin: the author describes an adaptation to mineral soils of the principle used by ODÉN.

The humic matter content of the mineral soil is estimated by comparing the soil extract with a N/100 standard solution of *Acidum humincum* (Merck.). Estimations were made on freshly prepared soil extracts, as it found that in strongly alkaline solution the colour intensity diminishes in a few days through oxidation.

By the method described it is possible to estimate the amount of *Acidum huminicum* which is colorimetrically equivalent to that extracted from the original weight of soil. This amount expressed as a percentage of the weight of organic matter in the same quantity of soil represents the degrees of humification of the organic matter, that is, the humification number used by ODÉN. W. S. G.

857. **The Value of Soil Analysis when Limited to an Intensive Cropping System.**

MCGEORGE, W. T. (Experiment Station, Hawaiian Sugar Planters' Association). *Soil Science*, Vol. XVII, No. 6, pp. 457-462. Baltimore, Md., 1924.

Owing to modern research being directed to the attainment of a more complete knowledge of the physiological properties of the plant which in their turn depend upon the variations in the food supply, soil analyses have lost much of their value as a guide to the application of fertilisers because they cannot keep pace with the changes taking place in the growth of the plant, nor with its powers of adaptation. The system of analysis hitherto employed which consisted in dissolving the soil sample in strong acids, may give some information respecting the reserve substances present, but tells nothing about the immediate crop, unless some idea of the availability of the different substances can be obtained.

Aqueous extraction is useless in the case of soils with a high colloidal content, for colloids endow the soil with strong fixing properties. Analysis

by means of dilute acids has no theoretical basis to recommend it. The only way of ascertaining whether any given analytic method is satisfactory is to make many experiments on the crop and compare the results with the data obtained by means of analysis. The Hawaiian islands are very suitable for this work, as sugar-cane is the chief crop grown there and it is cultivated without intermission or rotation, therefore the nutritive elements are continually being extracted from the soil and there are no factors to increase the availability of these substances. The crops vary considerably in the different parts of the island ; this variation is chiefly due to the environment, moisture, etc., for the difference in the mineral constituents of the soil appears to be of minor importance. The author carried out comparative experiments in places where the soil was respectively responsive and unresponsive to potassic fertilisers. The phosphates and potassium were extracted with nitric acid (0.2 %), hydrochloric acid and citric acid (1 %). The citric acid method proved useful for determining the amount of fertilisers required. There exists a certain connection between some forms of silica and of lime, soil reaction and phosphate availability. The response to fertilisers is typical in the case of high-lying soil and absent on low ground ; it is met with in soils containing an average amount of 0.17 % of citric acid-soluble phosphates.

The availability of potassium is greatly influenced by the physical composition of the soil, the lime content and the reaction of the soil. It is lowest in districts with abundant rainfall. Soils containing 0.009-0.017 % of citric-acid-soluble K_2O are responsive of potassic fertilisers.

A. F.

858. **The Criterion of Uniformity of Soil in Field Experiments.**

KOTOWSKI, F. Spółczynnik jednolitosciglcby ' jagozastosowanie do dós wiadozén polowych. *Roczniki Nauk Rolniczych*, Year XI, No. 1 pp. 26-55. Poznan, 1924.

Taking as his basis the results of his own experiments on potatoes and the data obtained by GORKI and STEFANIOW from their work on oats, the author has determined by HARRIS's method the correlation efficient of the different compositions of the soil in the experiment fields. The data obtained were calculated as quantitative coefficients. The experiment plots were laid out on a zone of soils that were as homogeneous as possible in order to profit to the utmost extent from the experiment area. The criterion of the homogeneity of the field was a complement and a confirmation of the calculations arrived at by biometric analyses, the theory of probabilities and practical experiment.

A. C. M.

859. **Colloid Chemistry in Relation to Agriculture.**

PATTEN, A. J. (Agricultural Experiment Station E. Lansing, Michigan). *Journal of Official Agricultural Chemists*, Vol. VII, No. 3, pp. 150-156. Washington, D. C., 1924.

The author shows the great importance of colloid chemistry from the agricultural standpoint and foreshadows that many of the problems that

now perplex the scientific investigator will probably be solved by means of the chemistry of the colloids. A. F.

Fertilisers and Manures.

860. **Definitions of Terms and Interpretation of Results of Analysis.**

Report of the Committee on Definitions of Terms and Interpretation of Results on Fertilisers. *Journal of the Association of Official Agricultural Chemists*, Vol. VII, No. 3, pp. 212-217. Washington, D. C., 1924.

At the meeting held this year, the above Committee dealt with the following products :

Basic slag. — This must be finely ground and should not contain any foreign material introduced after its manufacture. It must contain, at least, 12 % of phosphoric acid (P_2O_5) of which 80 % is soluble in 2 % citric acid (WAGNER'S method). Slags not fulfilling these requirements must be classed as low grade products.

Lime. — Should be applied in a form capable of neutralising soil acidity to the same extent as the oxide, hydroxide, carbonate etc. of magnesia.

Dry fertilisers whether ground, or crushed, should not contain any other ingredients than those specified.

Fertilising salts. — This term is applied to potassic salts with a high percentage of chlorides and 20-30 % of potassium (K_2O).

Magnesio-potassic sulphate should not contain less than 25 % potassium (K_2O), 25 % magnesium sulphate and 2.5 % of chlorine.

Organic nitrogen in fertilising mixtures. — This can only be estimated by the neutral (STREET) or the alkaline (JONES) permanganate method when the water insoluble nitrogen amounts to $\frac{1}{3}$, or more, of the total nitrogen. The quantity of nitrogen is sufficient if, at least, $\frac{1}{4}$ of that found is water-soluble. The activity of the insoluble nitrogen must be 50 %, or more, with alkaline permanganate and 75 %, or over, with neutral permanganate. A. F.

861. **Studies in Crop Variation.**

MACKENZIE, W. A. (Rothamsted Experimental Station). *Journal of Agricultural Science*, Vol. XIV, Part 3, pp. 434-460, tables 12. London, 1924.

The results of a statistical analysis of the yield of dressed grain from the Broadbalk Wheat Field, Rothamsted, were published in 1921 by R. A. FISHER (*J. Agric. Sci*, II, Part II, 1921) and the present paper gives the results of a similar analysis of the Hoos Barley Field of the same Station. Thirteen plots have received the same manurial treatment since 1852, and these were selected for analysis, the examination extending over the 70 years, 1852-1921.

The object of the study was to determine the slow changes which have taken place in the mean yield of these plots, and to indicate the relation-

ships between manurial treatment and mean yield and deterioration respectively.

The results obtained are summarised as under :—

1) Of the three sources of nitrogen, rape cake gave the highest mean yields in the absence of superphosphate ; nitrate of soda gave results significantly better than ammonium salts.

2) Superphosphate is of importance to the barley crop, giving greatly increased yield.

3) Sulphate of potash seems to have an adverse effect on the barley yield.

4) The deterioration of the barley plots is much greater than the wheat plots. Part of the diminution in mean yield may be be due to slow changes other than deterioration

5) The mean annual percentage diminution is least on those plots n receipt of superphosphate, and emphasises the importance of phosphoric acid not only in increasing the mean yield, but in maintaining the fertility of the soil.

6) Barley is more variable than wheat and is more subject to the influence of meteorological conditions.

7) The slow changes other than deterioration, are relatively unimportant and seem closely connected with manurial treatment.

W. S. G.

862. Manuring Peat Soils.

HANSEN, J. Experiments in the Application of Marl, Lime, Liquid and other Manures to Peat Soils. *Tidts-skrift for Planteavl*, Vol. 29, Part 1, pp. 1-27. Map and Tables, 1923.

These experiments were carried out at the Askov Experiment Station on high peat moors where the peat was 4 metres in depth.

Drainage experiments. — The draining was effected by means of open ditches, 5.7 m. 11.3 m. and 22.6 m. apart, and 63 cm., 94 cm. and 127 cm. deep. The highest yields of cereals and leguminosae were obtained when the distance between the ditches was 11.3 m. ; lower yields were produced where the drains were 5.7 m. apart, and 25 % less with an interval of 22.6 m. On the other hand, the best crops of hay were grown where the 2 widest spaces were left between the trenches.

Liming and Marling. — Carbonate of lime was applied at the rates of 18 000 and 36 000 kg. per hectare, the best results being obtained with the larger amount in the case of vetches, rye and oats, and with the smaller quantity in that of mixed cereals (barley and oats).

Lime and marl were equally efficacious when they were applied to peat soils that had been spread with a layer of sand 5 cm. deep. If the sand was 2.5 cm. thick, the crop yield was 8 % higher when marl was used, while it was 33 % higher when marl was applied without any sand.

Nitrogenous manures. — Excellent results were obtained by the application of nitrogenous manures to high peat moorland cropped with cereals and gramineae, an increased yield of 20-30 % being reported.

R. D.

863. **A New Method for the Utilisation of Farm-Manure.**

KRON, O. Eine neue Tecknik der Mistausnutzung. *Die Technik in der Landschaft*, Year 5, No. 1, pp. 11-15, and No. 2, pp. 29-31, figs. 14. Berlin, 1924.

Although nitrogen is the most expensive fertiliser and constitutes the most valuable part of farm manure, 30 % of this substance is lost in the dung-heap even in well-managed farms. Further, it has been found by experiment that when the manure has been dug in only 25 to 70 % of the initial nitrogen is even used by the crop. Thus it may be said that under the most favourable conditions, barely 17 % of the initial nitrogen of the dung is used by the plants. Hitherto, efforts have been directed to decreasing the losses of nitrogen that take place in the manure-heap, but it would have been far more useful to try and increase the utilisation of the nitrogen by plants as is shown by the preceding figures. If all leaching from the dung hill were prevented, only 25 % of the nitrogen could be used, whereas if the crops turned to full account the manure applied to them 70 % of the initial nitrogen would be utilised. Thus, the increase would be 25-17'5 = 7.5 % in the first case and 70-17.5 = 52.5 % in the second.

Dr. KRANTZ has devised a method for improving the quality of farm-manure.

Fresh dung applied to plants has a negative effect, viz., it decreases the yield owing to the dinitrifying action of bacteria. For this reason, the manure is left to decompose, or ferment, on the dung-heap or the field. The object of the KRANTZ process is to regulate this fermentation which it does by: *a*) rendering the insoluble proteins available for plants; *b*) destroying the denitrifying bacteria ; *c*) arresting fermentation after these two objects have been attained. As a result of this process, the dung keeps well, does not part with any of its nitrogen and supplies to the plants substances that are easily assimilated, thus greatly decreasing the losses on the field.

The manure is piled up on a moderately high heap without however being pressed down, this allows of rapid fermentation with great rise of temperature. When a certain point is reached, the manure is compressed, so as to drive out a considerable portion of the air. This lessens the fermentation. The pressure is kept up by piling fresh dung upon the old ; in this way, the heat of the first layer cannot be lost and any straw that has escaped fermentation so far, is brought under chemical and biological influences. The great heat which still persists in the interior of the heap also aids in promoting thorough fermentation. KRANTZ decided that this pressure, combined with the retention of the internal heat of the mass, could be employed in the preparation of green manures and found that the crops not only benefited directly from the application of the manure thus treated, but were entirely free from weeds, therefore the process is of the utmost value to farms poor in live-stock and to arable farms.

The KRANTZ method has been adopted on a large scale since the autumn of 1920, on the Konradsdorf estate at Stockheim (Hesse, Germany). The objections to the process are as follows.

1) A large staff is needed.

2) Much heat escapes from the manure brought hot from the stable; the irradiation takes place from the upper layer and the sides of the heap and is shown by the lengthened fermentation.

3) Heat losses occur subsequent to fermentation. These are considerable since after more than 6 months, the temperature of the interior of the heap was still 40°C. (Table LIII fig. 121).

4) The necessity of making the heap in a pyramidal form in order to insure its stability and prevent the loose layers from slipping (Table LIV fig. 122).

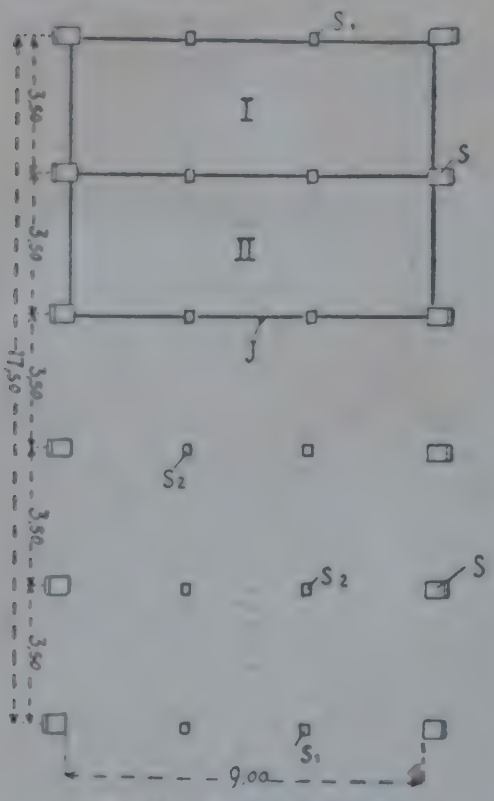


FIG. 125. — Plan of manure storage plant (21 m. by 9 m.).
I = Compartment completely filled;
II = Compartment in course of filling;
S = Columns of reinforced concrete; S_1
S_2 = Movable wooden columns.

5) Owing to the staircase construction of the heap (Table LV and LVI), insufficient pressure is exerted on a large part of the dung which much interferes with the process of fermentation.

All these defects can, however, be remedied by the use of a manure elevator and by piling the dung in silos. It is necessary that the silos should be constructed in such a manner that the manure can be easily, quickly and simultaneously removed through openings that do not allow the heat to escape, the light to penetrate, or the contents to slip. The only means to insure all these *desiata* is to have a fixed frame with compartments separated by movable divisions.

The author describes the silo constructed and patented by him and gives numerous diagrams to show its working. Fig. 123 represents one of these silos with the top off to show how the manure is transported.

The operation is carried out as follows (see fig. 125). First the manure in compartment I is moved. The manure collected the first day is placed in a loose heap measuring 3.50 m. at the bottom and piled up to a height of about 70 cm. The width of the heap depends on the amount of manure. The manure of the second day is placed alongside and this process is repeated until all the surface of compartment I is covered. Then a second layer is put on the stratum deposited on the first day, which in the interval has begun to ferment and has become compressed, this process is repeated until the heap has reached the right height (as a rule 6 m.). Movable divisions fixed to columns are inserted to keep the heap in its place.

The size of the silo depends upon the amount of dung produced on the farm. Its position is regulated by the situation of the buildings (machine-

PLATE LIII.

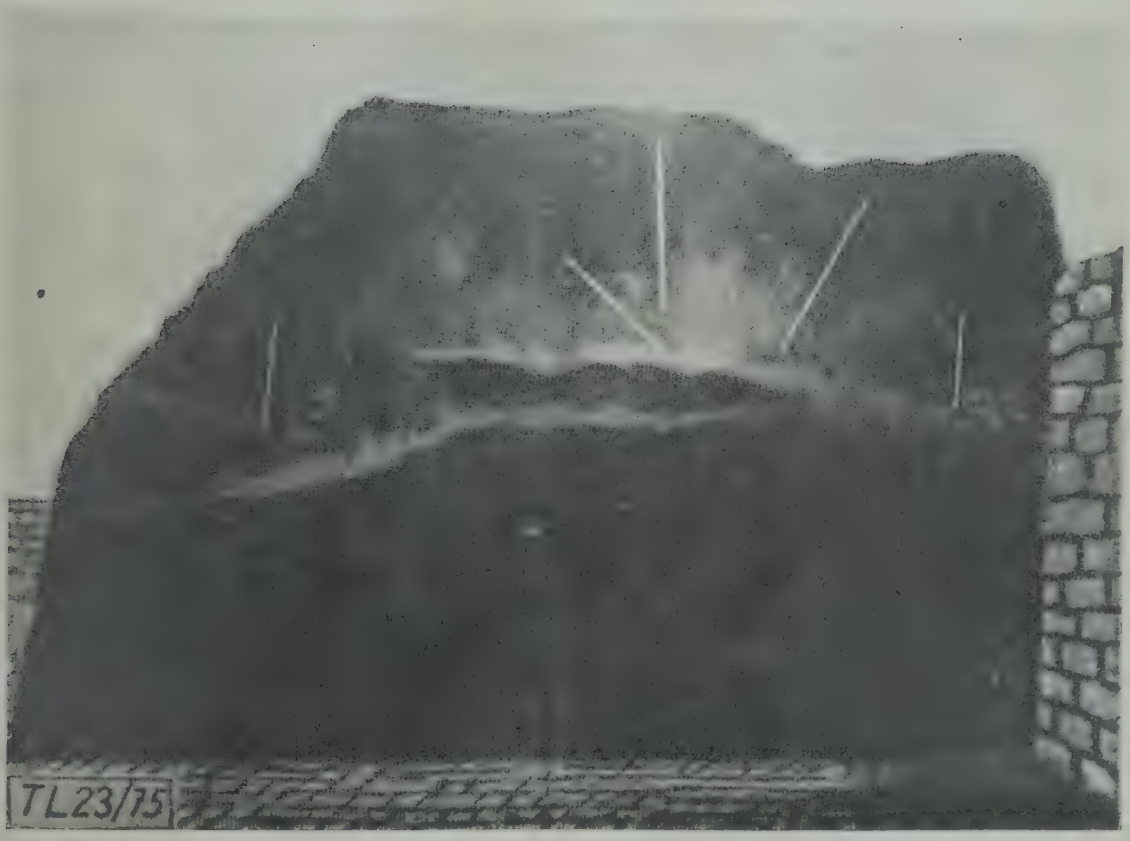


FIG. 121. — Sides of the manure heap slightly exposed. Note the vapour from the heated mass even after standing for some time.

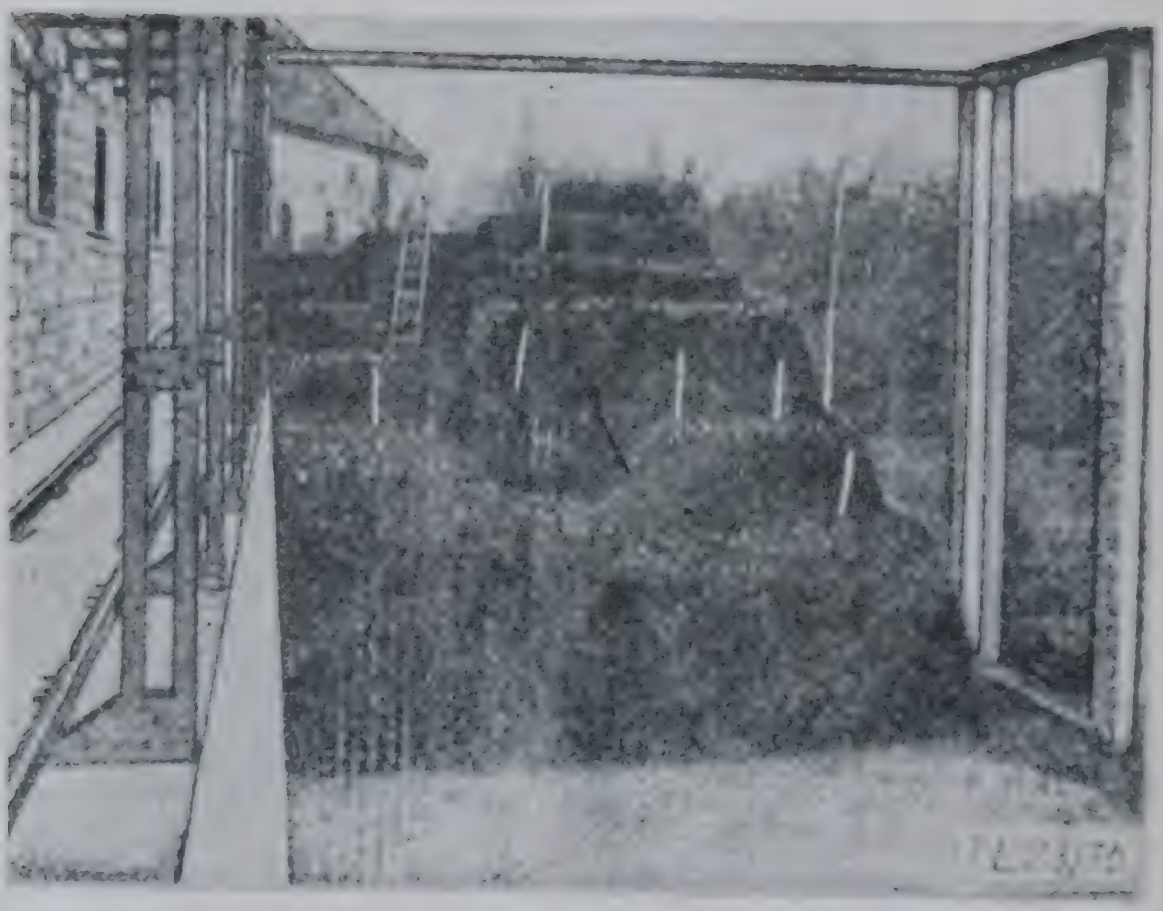


FIG. 122. — Farmyard manure of Konradsdorf, front view.

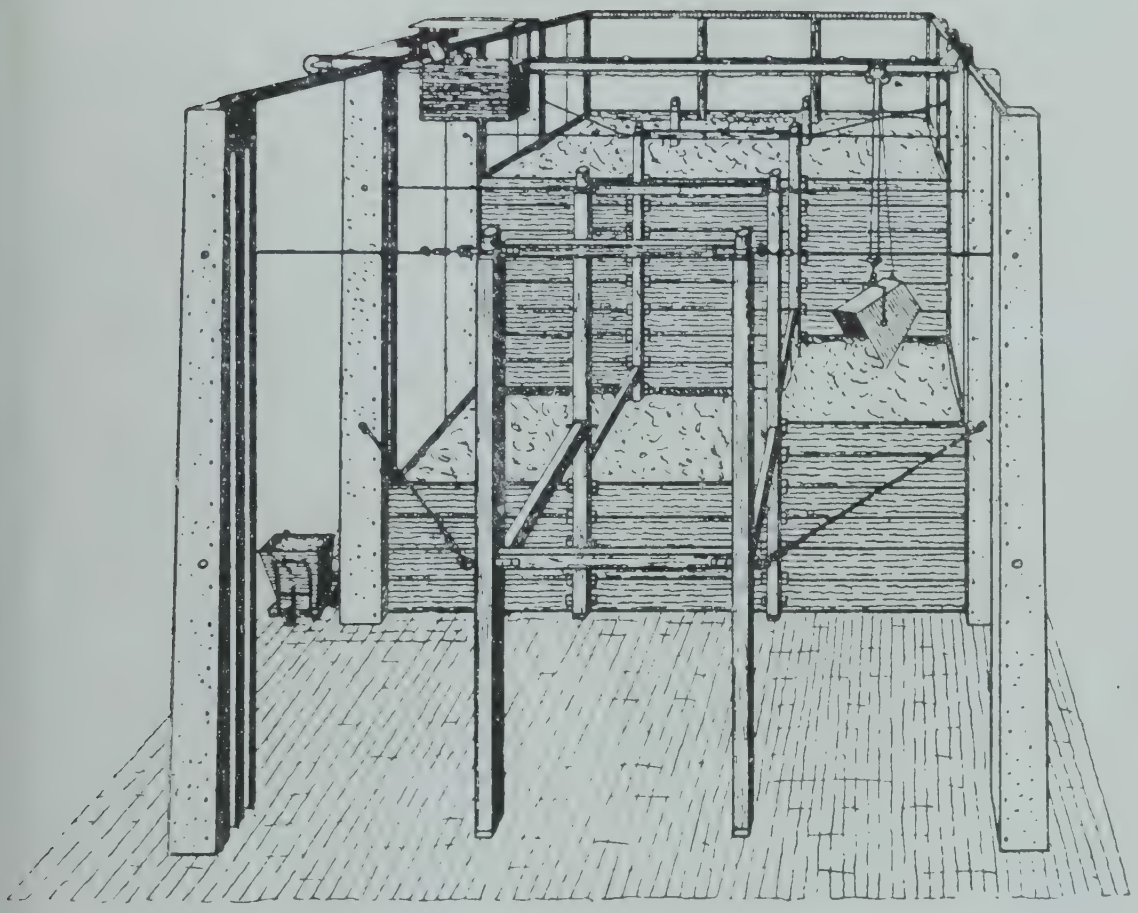


FIG. 123. — Interior of the manure shed at Konradsdorf.

FIG. 124. — Farmyard manure of Konradsdorf, side view.

shed, stable, granary, etc.), economical arrangements being made in the manner shown by the author. The external pillars should preferably be constructed of reinforced concrete.

During fermentation, a liquid with a high nitrogen content flows from the heap, which forms about 15 % of the dung and should be kept under the same conditions as liquid manure.

Excellent results have been obtained from the application of dung thus prepared.

KRANTZ manure is twice as efficacious as the ordinary product, for when applied at the same rate as the latter, the yield is doubled.

R. D.

864. *Melilotus indica* and Autumn Plant Sugar Cane.

TAGGART, W. G. *Louisiana Planter and Sugar Manufacturer*, Vol. LXXIII, No. 8, pp. 150-151. New Orleans, 1924.

An ample supply of available nitrogen is essential to sugar cane and investigations were carried out by the author to select the most suitable leguminous plant to act as a nitrogenous green manure crop.

Yellow sweet clover (*Melilotus indica*) was chosen finally, as the clovers were found to have certain drawbacks.

It was found that melilotus sown on autumn plant cane and turned under in the spring will add to the soil about 20 000 lb. of green matter per acre, at a cost of from $1.25 to $3.

The seed is sown broadcast at the rate of 20 to 25 lb. per acre over cane lands after the rows have been built up. If melilotus has not been grown before, it is well to inoculate the land with about 200 lb. per acre of top soil from a field where it has been grown satisfactorily.

A large number of planters have tried this crop and report that the stand of cane is not injured and that increased yields of from 20 to 30 % are obtained.

W. S. G.

865. The Phosphoric Acid Problem in Germany.

NIKLAS, H., and SCHARRER, K. Über das Phosphorsäureproblem. *Chemiker Zeitung* XLVIII, Nos. 29-30, pp. 121-122. Cöthen, 1924.

The authors first describe the agricultural problems that post-war Germany is called upon to face and show the extent to which the country is indebted for its supply of nitrogen (the motive power of all agricultural activity) to the HABER-BOSCH, OSTWALD and SCHOENHERR processes for the fixation of atmospheric nitrogen in the form of ammonia, or according to FRANK-CARO, in that of calcium nitrate.

They then pass on to consider how Germany stands as regards potassic fertilisers (necessary for acid soils), but it appears that the rich deposits of potassic salts existing in the country, especially at Stassfurt, preclude all anxiety on this account.

The phosphoric acid question is very much more serious, since nearly all the phosphatic deposits are situated abroad. The authors give the names of a few factories using German phosphates for the produc-

tion of fertilisers, and state that crude phosphates are now frequently applied directly to the land, since TACKE and NEITMAIR maintain that all that is required is that the phosphoric acid in the fertiliser should be in a form capable of being displaced by the carbon dioxide of the air, the soil acids and the acids of the plant roots. This hypothesis is however still under discussion and it is possible that the application of crude phosphates may have the fatal effect of making the soil acid.

Other investigators have suggested mixing the crude phosphate with powdered sulphur, in which case, the phosphoric acid would be displaced by the sulphuric acid liberated by the oxidation of the sulphur. Satisfactory results have been obtained by LEMMERMANN with the so-called colloidal form viz., crude phosphate mixed with $^2/_3$ of silicic acid. The true solution of the phosphoric acid problem would, however, seem to be the discovery of new deposits of phosphatic minerals in Germany, although in the future, it may be possible to obtain access to the deposits of phosphates which exist in Russia, but these vary greatly in value from the standpoint of the agricultural chemist.

A summary is given of PRJANISCHNIKOWS' researches on the phosphoric acid yield of many qualities of phosphates and whose investigations show that phosphorites being more widely diffused in nature than other phosphates, are likely to be most used in agriculture in spite of their lower phosphoric acid content.

In conclusion, the authors describe PALMAER's electrochemical method which consists in oxidising phosphorite by means of perchloric acid produced by the hydrolysis of a saturated solution of sodium perchlorate. PRJANISCHNIKOW suggests another method viz. the decomposition of crude phosphate by means of nitric acid, the phosphoric acid liberated being fixed by milk of lime.

G. B.

866. **The Influence of Silica, Lime and Soil-Reaction upon the Availability of Phosphates in highly Ferruginous Soils.**

McGEORGE, W. T. (Experiment Station, Hawaiian Sugar Planters' Association). *Soil Science*, Vol. XVII, No. 6, pp. 463-468, bibliography. Baltimore, Md., 1924.

The author conducted his experiments on the soils of the Hawaiian islands which are very rich in iron and lime. A distinct relation was found between silica solubility and the response of the soil to phosphatic fertilisers and therefore great availability of phosphates is accompanied by high silica solubility. Soils with a hydrogen ion concentration of pH reaction 4.6-6.5 respond more readily to phosphatic fertilisers than others with a pH reaction 5-5.2. A similar relation was discovered in the case of lime, soils containing least lime (in the form of carbonate and sulphate), derive most benefit from phosphatic fertilisers. This shows the great influence exerted by lime upon the availability of the phosphates contained in highly ferruginous soils with much alumina. This availability increases in virgin soils in the course of their cultivation probably in account of the buffer

action of the calcium bicarbonate formed by the introduction of carbon dioxide as a result of aeration.

These findings have been proved correct by practical experiments. There is in fact a distinct connection between hydrogen-ion concentration, silica solubility and the phosphoric acid content of the crop.

A. F.

867. **Phosphates in Morocco.**

L'exploitation des phosphates marocains. *Annales de l'Institut Colonial de Bordeaux*, March, 1924, p. 89. Bordeaux.

The output of Moroccan phosphate reached 190 000 tons in 1923 as compared with 80 000 tons in 1922 and 8 000 in 1921. The beds investigated at present, between El-Bouroadj and Oued-Zem are about 80 km. in length and 50 km. broad and the phosphatic deposits have a thickness of from 25 to 50 cm. If the output were increased ten-fold, it would take several centuries to exhaust the El-Bouradj deposits.

W. S. G.

868. **Mexican Phosphates.**

I fosfati del Messico. *Rassegna mineraria, metallurgica e chimica*, Year XXX, Vol. IX, No. 6, pp. 133-134. Rome, 1924.

The phosphatic deposits discovered by BURCKHART some years ago in the northern States of Mexico are situated in the Upper Jurassic formation and those so far investigated contain up to 57 % $Ca_3 (PO_4)^2$. Their position is very favourable owing to the proximity of Texas, a large centre of consumption, and to their being within easy distance of the great waterway of Rio Grande which will render these phosphates available for those States of the North American Union that have been obliged to exploit home deposits lying at a far greater distance.

Further, the conditions for treating the raw meterial are very satisfactory, for there are large quantities of sulphides that are never used ; the sulphurous acid escapes into the air, as none of the large companies engaged in roasting pyrises, galena, or pitchblende, trouble to manufacture acids. From calculations made by experts, it would appear that about 40 tons of sulphur are lost every 24 hours.

The deposits of phosphates generally are inclined between 35° and 60°; no horizontal beds have yet been found. The depth of the strata containing the phosphates ranges from 28 to 45 metres and the deposits are 45 cm. to 3 m. thick. The phosphates are green or red in colour, the green layers contain little iron and clay. The deposits are situated in a district with a very low rainfall and at an altitude varying from 2300 to 2600 metres above sea-level. Three of the phosphate deposits are well situated as regards the railway, being only 8 km. distant from it.

A. C. M.

869. **The Availability of Phosphoric Acid in Basic Slag Phosphates.**

Final Report of the Special Committee of the Association of Official Agricultural Chemist. *Journal of the Association of Official Agricultural Chemists*, Vol. VII, No. 3, pp. 218-252. Washington, D. C., 1924.

The American Association of Official Agricultural Chemists appointed a Committee in 1911 for the purposes of collecting data on the availability of the phosphoric acid in basic slags and of testing WAGNER's method of determining the said availability. The experiments were made in pots and in the field at ten Agricultural Experiment Stations and on different soils. The details and results are given in the Report.

Four types of basic slag contained a very available form of phosphoric acid and gave satisfactory results as to crop yield and quantity of phosphates.

The researches proved the efficiency of WAGNER's analytic method in the case of slag and of the neutral citrate of ammonia method in that of superphosphates. A. F.

870. **The Recovery of Potash as a By-Product in the Blast Furnace Industry.**

MERZ, A. R., and ROST, W. H. *United States Department of Agriculture, Bulletin*, No. 1226, pp. 21, bibliography. Washington, D. C., 1924.

The authors in the first place draw attention to the fact that a considerable amount of potash suitable for fertilisers can be recovered not only from cement furnaces, but also from blast-furnaces (ROST, W. H. Extraction of Potash from Natural Silicates, Circular No. 71, Bureau of Soils pp. 1-10. Original Communication, *Eighth International Congress of Applied Chemistry*, No. 15, pp. 217-229, 1912), although the amount of K_2O recoverable is more difficult to calculate in the case of the blast-furnace, since the substances with which it is fed (mineral iron, limestone, or dolomite, and coke) are derived from different sources, vary greatly in chemical composition and are mixed every time in different proportions. If, however, the average amount of each substance consumed annually is taken into account, as well as its average potash content (found by analysis) there is no difficulty in calculating the total quantity of K_2O that passes into the blast-furnace, while by means of a large number of analyses the average amount of K_2O contained in the slag produced annually can also be estimated.

On substracting from the potash annually introduced the amount that has been recovered from the slag, we obtain the quantity of potash annually lost by volatilisation in the blast-furnace industry.

The authors give statistical data showing that 84 000 tons of K_2O are annually volatilised in the United States in the above industry, whereas 87 000 tons are thus lost in the cement industry. It must, however be remembered that the number of blast-furnace plants in the United States is more than double that of the cement furnaces. Further, in each plant much less potash was recovered from the blast-furnaces (unless in special

cases where the furnaces were fed substances unusually rich in K_2O), than from the cement furnaces.

In order to recover much potash from blast-furnaces, the authors state that a more modern system of purifying the furnace gases must be adopted in place of the washing method now in use. They advise a dry system (for instance, the COTTRELL precipitator, HALTERY and BETHS' system and the KLING WIEDLEIN system).

Although owing to the large number of existing blast-furnaces, the precipitate from the gases would form a considerable potential source of K_2O to be drawn upon in case of need, the authors do not consider the regular recovery of the potash advisable in every instance.

L. M.

871. **The Recovery of Potash from Kelp.**

ROBISON, S. C. (Macdonald College, P. Q.). *Scientific Agriculture*, Vol. IV, No. 10, pp. 314-321, bibliography. Ottawa, 1924.

The author gives a brief account of pre-war sources of potash, mainly from the economic standpoint and then describes in detail the two most important varieties of seaweed from which kelp is made, *Macrocystis pyrifera* and *Nereocystis luetkeana*. These species are found in groves along the Pacific Coast, Alaska and other areas ; the Pugel Sound groves alone are estimated to yield 390 000 tons of wet kelp per year, and those in South Eastern Alaska 8 000 0000 tons.

The potash and iodine content varies with the species and the locality ; the iodine content diminishes in northern waters.

(Dried)	% Potash	% Iodine	% Nitrogen
Nereocystis Max.	31.62	0.28	2.53
Min.	13.30	*nil*	0.98
Macrocystis Max.	18.30	0.26	2.69
Min.	6.92	*nil*	0.74

The nitrogen content varies inversely as the potash. Sodium occurs to the extent of one-third the total weight of potassium.

The following is a list of methods of treatment of kelp for agricultural purposes :

(*a*) Partial drying, separation of efflorescent salts. Drying and grinding the residuum for use as a low-grade potash fertiliser ;

(*b*) Extraction of most of potash and iodine by lixiviation from fresh material ; evaporation of solution to dryness and charring, followed by separation of potash and iodine ; residuum dried and ground to form humus fertiliser ;

(*c*) Complete charring and lixiviation of kelp. Only 80 % of iodine can be recovered. ;

(*d*) Dried and ground kelp as crude source of potash applied directly to land. Iodine is lost and cost of transport increased.

A comparison was made of the material values of alunite, kelp, po-

tassium sulphate and potassium chloride, the amounts applied being equivalent in potash; the kelp was dried and powdered. The best result was given by potassium sulphate and the worst by raw alunite; potassium chloride and kelp were approximately of equal value.

W. S. G.

872. **The Origin of Saltpetre in Chili.**

STOKLASA, J. Über den Ursprung des Saltpeters in Chile. *Chemiker Zeitung*, Vol. XLVIII, No. 1, p. 4. Cöthen, 1924.

Chili saltpetre, or "Caliche", comes chiefly from the province of Tarapaua and may be divided, from the technical point of view, into three qualities, the best contains 40-50 % of sodium nitrate, the medium 30-40 % and the most inferior 17-30 %. The author states that very similar results are obtained from the analysis of "Caliche" (freed from sodium nitrate) and of volcanic products. Large quantities of ammonium chloride have been found in the hot lava of Vesuvius. Eruptive products frequently contain nitrogen in the form of ammonia. The researches of the author have shown that the following substances are certainly emitted from the craters of volcanoes: sulphuretted hydrogen, ammonia, hydrochloric acid, hydrofluoric acid and carbon dioxide, while the lapillae, bombs red and grey ashes and also the lava contain: hydrogen, oxygen, sulphur, fluorine, chlorine, iodine, antimony, arsenic, phosphorus, boron, silicon, as well as potassium, sodium, strontium, barium, magnesium, zinc, aluminium, titanium, iron, nickel, cobalt, manganese, molybdenum, iron and bismuth.

"Caliche", "Koska", "Chuca" and "Loza" (the latter occurs in the surface of the natural nitrate beneath which is a rocky conglomerate known as "Coska"), were found on analysis to be radioactive. Radioactivity is a property of all volcanic eruption products and the ashes of certain extinct volcanoes of Czecho-Slovakia are highly radioactive.

The author gives the various theories held respecting the origin of "Caliche". According to the oldest hypothesis, it is derived from animal excrement and from the actual bodies of animals.

NOLLNER (1868), believed it to have been formed from marine seaweeds, for as is well known, these plants contain iodine, a substance also found in "Caliche". GAUTHIER and MATTEUCCI however have proved that traces of iodine are also to be met with in volcanic products.

The author is opposed to NOLLNER'S theory since it is difficult to believe that the enormous amount of nitrogen present in "Caliche" is not due to the nitrifying of ammonium of volcanic origin. This solution indeed seems the more probable seeing that Chili is a very volcanic country. Further, marine plants could not well have produced a similar amount of nitrogen, and as littoral deposits of seaweeds are poor in radioactive substances, the radioactivity of volcanic regions situated on the coast must practically be wholly due to the eruptive products occurring there.

Manurial experiments with *Beta vulgaris* have proved that the nitrogen derived from natural sodium nitrate is more effective as a fertiliser than nitrogen from artificial nitrate ; this is probably due to the fact that in Chili nitrate, iodine is constantly found under the forms of iodates and periodates and, as has been proved, iodine plays an active part in the metamorphoses of carbon within the cell and especially in the formation of pentoses.

It has been found that even 1.53-2.2 kg. of iodine in the form of iodide greatly increases the sugar percentage of sugar-beets. B.

873. **Is the Fertilising Property of Chili Saltpetre affected by the Presence of Iodine in the Nitrate itself, and by its own possible Radioactivity ?**

Von Feilitzen and H. Egner. Wird die Düngerworkung des Chil Salpeters durch seinen Iodgehalt und etwaige Radioaklivität des Salpeters beeinflusst ? *Chemiker Zeitung*, Year 45, No. 60, pp. 325-326. Cöthen, 1924.

According to Stoklasa, Chili saltpetre owes its origin to a combination of volcanic, biochemical and radioactive processes. This hypothesis renders superfluous any recourse to the marine-algae deposits theory of the nitrate, since the iodine always present in it is regularly found in volcanic products. Stoklasa's experiments which seemed to show that the different fertilising action of natural sodium nitrate as compared with the synthetic product needs confirmation, but German agricultural chemists are of opinion that the former is the more potent fertiliser which statement has not been opposed in any of the more recent manurial treatises.

Stoklasa regards the superiority he attributes to the natural nitrate (which he believes to have been proved by manurial experiments on sugar-beets) as due to the presence of iodine, but the case he quotes is not conclusive, because the iodine content of Chili saltpetre is so small as to exclude all idea of any general action on the part of the iodine.

A further objection has also been urged against Stoklasa's view : viz., the iodine in his experiments was applied in the form of iodide whereas, in natural nitrate of sodium only iodates and periodates are present. Since, however, no differences have so far been observed between the action of iodides and of iodates and periodates respectively this objection has no facts to support it.

The experiments hitherto made upon the action of iodine as a stimulating principle have yielded somewhat contradictory results. Loew is of opinion that traces of iodine are necessary to the development of maize, whereas Bohn and Winterstein maintain that the presence of iodine in cultivated plants is purely accidental.

Another theory put forward to account for the supposed superiority of the natural sodium nitrate is its possible radioactivity. Stoklasa considers the latter as a factor of little importance, whereas E. G. Doerell expresses himself on this point as follows " iodine has a very favourable action on their (the sugarbeets) development ; this is due to the presence of radium ".

Many fertilisers have been put forward as being radioactive, but they nearly all gave negative results. On being investigated, the radioactivity of some of these substances was found to be as follows:—

Commercial Chili Saltpetre	A = 0
White and brown "Caliche" A	A = 0
Whitish-Yellow "Caliche" B	A = 0
Catalytic radio-active fertiliser	A = 0.504

(A = total activity)

Although the present methods of investigation are not accurate enough to reveal minute traces of radium, the above date are sufficient for all practical purposes. G. B.

874. **The Action of Dicyanamide and Guanil Urea Sulphate on Plant Growth.**

McGUINN, A. F. (New Jersey Agricultural Experiment Station) *Soil Science*, Vol. XVII, No. 6, pp. 457-499, bibliography. Baltimore, Md., 1924.

Dicyanamide and guanil urea sulphate (the sulphate of diocyanamide), occur as impurities in synthetic urea in the proportion of 1-10%. Hence, it was very necessary to determine whether these substances are inimical to plant growth, for if they proved injurious it would not be advisable to use urea as a fertiliser.

The results of the author's experiments were as follows:

Neither dicyanamide nor guanil urea sulphate hinders or inhibits germination, if it is applied in small quantities and comes into direct contact with the seeds. Dicyanamide is mildly toxic when a large amount is used and forms the only source of nitrogen, otherwise the only injury done is to scorch slightly the tips of the seedlings. Guanil urea sulphate is not toxic to plants, even when applied in relatively large quantities, and forms a source of available nitrogen, although it is assimilated very slowly.

Excessively small amounts of dicyanamide arrest the nitrification process, but do not hinder ammonification. Guanil urea sulphate delays nitrification, but has no effect upon ammonification. Neither dicyanamide nor guanil urea sulphate acts in any way upon the bacteria or fungi of the soil.

Dicyanamide is fairly stable in the soil, and though guanil urea sulphate decomposes with the production of ammonia, the process is somewhat slow.

The fertilising property of urea is about equal to that of sodium nitrate and is not decreased even when the urea contains 10 % of nitrogen in the form of dicyanamide, or guanil sulphate of urea. A. F.

875. **Absorption and Leaching of the Nitrogen when Urea and Ammonium Chloride are Applied as Fertilisers.**

VAN HARREVELD-LAKO, C. H. (Proefstation voor de Javasuikerindustrie). De absorptie en uitspoeling van stikstof bij bemesting met ureum en met

ammonium-chloride. *Archiv voor de Suikerindustrie in Nederlandsch Indië*, No. 8, Soerabaja, 1924.

J. KUYPER had already published in the above "Archiv" (1923, p. 21) the results obtained from some comparative experiments carried out with urea and ammonium sulphate, which seemed to prove that there is little difference between the manurial value of these two substances. Subsequent experiments confirmed these results in the main, for only in two tests did the value of urea prove to be the lower. The present researches were undertaken with the object of studying the leaching of urea as compared with that of ammonium chloride and Chili nitrate. The experiments were made on different Java soils, care being taken to select types that while they were not sandy, still allowed leaching to take place. A liberal supply of water was insured by means of a column 21 cm. in height.

The chloride of ammonium was removed with difficulty, the maximum washed out being 1 %; even smaller values were obtained with ammonium sulphate, the differences recorded being negligible. On the other hand, as much as 88 % of the ureic nitrogen was washed out of the soils studied, while the nitrate nitrogen was entirely removed. From one soil (Maiong) which contained a small quantity of weathered tuff, all the urea was washed out. Probably a very small amount of the urea was absorbed by a soil constituent (presumably humus). Practically, urea and Chili nitrate are removed by water to about the same extent.

A. F.

876. **The Carbon Cycle and Carbonic Fertilisation.**

MANOE, L. Le cycle du carbone et la fertilisation carbonique. *L'industrie chimique*, Year XI, No. 121, pp. 56-58, No. 123, pp. 152-154. Paris, 1924.

The author gives a comprehensive description of the diagram reproduced on the figure and states what is known at present on the subject of the carbon cycle (See fig. 126). He also mentions the experiments of KREUSLER, KLEIN, REINAU, FISHER and RIEDEL as being especially interesting to agriculturists since they prove plant-growth to be much stimulated by the presence of small amounts of carbon dioxide in the atmosphere.

As is well-known, carbonic fertilisation insures a better utilisation of the soil by plants and enables them to assimilate larger amounts of nitrogen, potassium, phosphorus, etc., and thus to turn to better account fertilisers and stable manure. RIEDEL explains the good results obtained by using mould rich in humus for rapidly-growing plants as being due to the action of carbon dioxide. Experiments have proved that large crops can be obtained by means of carbonic fertilisation, and LEVERKUSEN even goes so far as to say it will become in time an absolute necessity.

The author treats of the conditions necessary for the formation of peat, lignite and petroleum.

The existence of peat seems to be essentially due to the presence of a great abundance of aquatic, or moisture-living plants, growing on a soil that retains water easily, and to a very high temperature causing a luxurious

but low growth, so that decomposition may not take place very rapidly. Peat generally contains 45-65 % volatile matter with a percentage of carbon of from 25-60, oxygen 30-55, hydrogen 5-8, nitrogen 0.5-3.5, ash rarely below 5. The most important elements of the ash are lime 6-45 %, iron oxide 5-70 %, sulphuric acid 4-18 %, magnesia up to 24 %, sodium up to

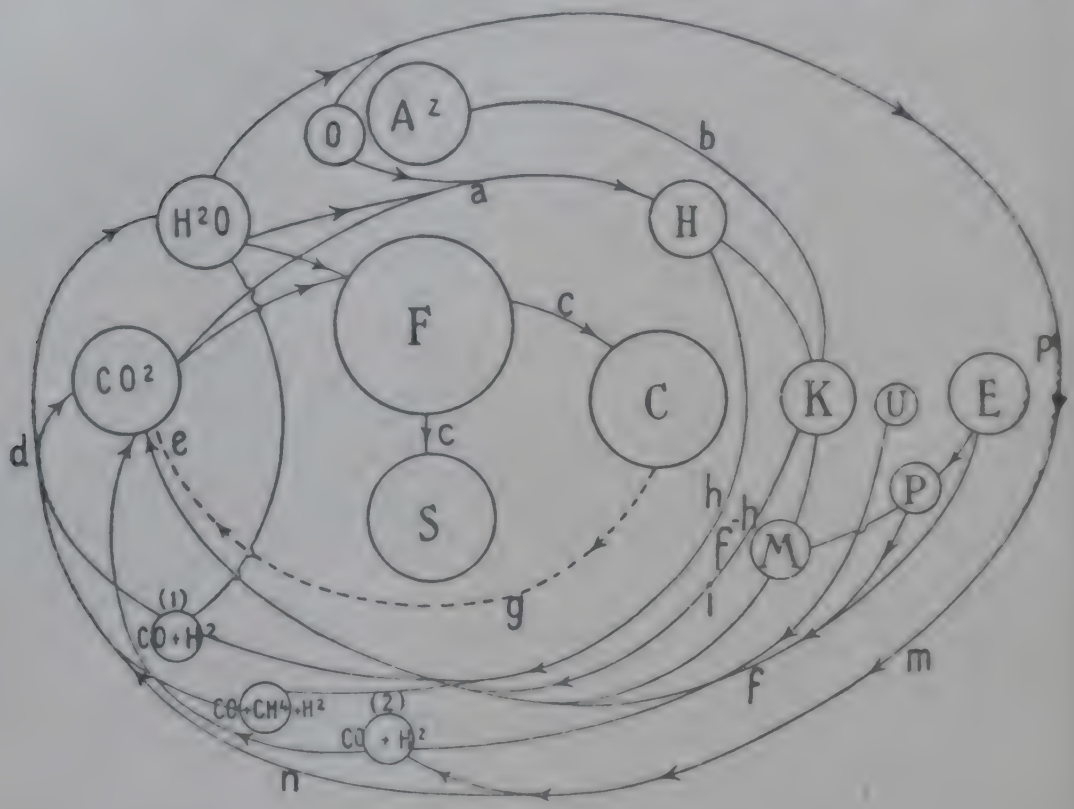


FIG. 126. — The carbon cycle.

Az = nitrogen ; O = oxygen ; H_2O = water ; CO_2 = carbon dioxide ; F = feldspar H = carbohydrate ; C = calcium carbonate ; E = fossil carbon ; K = nitrogenous organic matter ; U = humus ; a = assimilation of chlorophyll ; b = bacterial action and synthetic factors ; c = sedimentation ; d = secondary combustion ; e = direct combustion ; f = respiration combustion ; g = calcination ; h = respiration ; i = putrefaction ; m = atmospheric oxygen and water vapour ; n = indirect combustion ; P = petroleum ; M = animal products ; S = aluminium silicate (clay).

6 %, potassium up to 4 %, aluminium 1-3 %, phosphoric acid 1-7 %, carbon dioxide up to 30 %, hydrochloric acid 3 %. The heating capacity of peat varies from 4000 - 5800 calories per kg.

Lignites are found in Tertiary rocks and may be divided into 4 distinct classes : *lignite composed* of fossilised tree-trunks that have been compressed and blackened by remaining long buried, but still retain their ligneous structure ; *earthy lignites*, pulverent masses closely resembling peat ; *dry lignite*, a dark brown, or black fuel which is hard, resonant, tenacious and dull rather than glossy; *oily lignites* that are softer, and more inflammable and disintegrate when subjected to heat.

Coal and anthracite are fuels found in the Lower Secondary, or Upper Primary, rocks. Coals form a continuous series from lignite up to anthracite and contain a percentage of carbon ranging from 50-90. According to RENAULT the following formula expresses more or less accurately the reactions that have taken place :

$$\underset{\text{plant fibre}}{(C_6\ H_{10}\ O_5)}\ 8 = 2\ \underset{\text{Coal}}{(C_9\ H_6\ O)} + 14\ \underset{\text{Methane}}{(CH_4)} + 16\ \underset{\text{Carbon Dioxide}}{(CO_2)} + 6\ \underset{\text{Water}}{H_2O}$$

Petroleum (1) is probably formed from plant or animal remains. The slow alteration of organic matter produces a continual return of carbon to the state of CO_2, which is taken up again by plants and thus resumes its endless cycle. A. C. M.

877. **Agents Stimulating Plant Growth.**

LOEW, O. Über Reizmittel des Pflanzenwachstums. *Chemiker Zeitung*, Vol. XLVIII, No. 71, pp. 391-392. Cöthen, 1924.

The author defines the term, stimulating agent, and quotes HÜPPE'S fundamental biological law according to which any substance that kills the protoplasm if used in a given concentration, will only retard growth if employed in smaller doses, and will act as a stimulant increasing the vitality of the organism if the quantity introduced is still smaller.

On using different substances as stimulants it is seen that the increased development produced may be due to various causes ; the stimulant may act favourably upon the respiratory function, or it may hasten certain processes taking place within the cells, or even increase chlorophyll activity.

The author enumerates the experiments he has made, but states that many of them have only a theoretical value because the substances used as stimulants were very expensive. The experiments conducted with manganese salts, sodium fluoride and potassium iodide can however be regarded as of practical importance, and data are given showing the improved yield due to potassium iodide.

Sodium fluoride produced a crop increase of 18 %. As regards the manganese salts, it should be observed that the weaker action of the carbonate as compared with the sulphate, is perhaps due to the finer subdivision of the latter.

The author then studies the effect of stimulants on different species of plant and states that Leguminosae are more susceptible to stimulants than Gramineae, tobacco plants are favourably affected by manganese sulphate and to an even greater extent by manganese sulphate mixed with iron sulphate ; the latter possesses a strong stimulaing property as was shown by HILTNER, who used it in cultural experiments with lupins. The author has found that better results are obtained if the man-

(1) See *R.* June 1920, No. 626, and *R.* July, 1921, No. 704.

ganese is applied to the germinated seeds than if used before the seed is sown.

An account is also given of HOUDA's arboricultural experiments, with comparative data respecting the height and weight of plants manured with the following substances: calcium nitrate, manganese sulphate, iron sulphate, sodium chloride and sodium nitrate. The results show clearly the superiority of manganese sulphate.

It is necessary to consider the nature of the soil before applying any of these stimulating substances, for it would be ill-advised, for instance, to use manganese salts on land already containing sufficient compounds of manganese. SCHULZE has obtained good results from manuring sugar-beets with manganese, and STOKLASA draws attention to the beneficial effect of this substance in the presence of aluminium sulphate.

RIVS obtained good results with peroxide of manganese.

KAYSER and MARCHAND have found that sulphate of manganese encourages alcoholic fermentation.

Dr. HILTNER is at present engaged in very interesting researches on the action of manganese. A. F.

878. "Clumina", a New Fertiliser.

LO MONACO, D. Un nuovo fertilizzante "Clumina". *Le Stazioni sperimentali agrarie italiane*, Vol. LVII, Parts 4-5-6, pp. 213-239. Rome, 1924.

From observing the effect of asphyxiating gases on plant and animal substances, the author obtained the idea that chlorine gas might be employed for agricultural purposes, especially for stimulating seed germination. New seeds after having been gassed for a short time, especially in the case of peas, soon germinate and send out a radicle and long plumule. Wheat and bean seeds that have been subjected to the action of chlorine were found to germinate sooner than the controls and to flower and fruit more freely. There was also a great difference between the underground and the aerial parts of wheat plants that had been treated, as compared with the control specimens.

The halogens dissolved in the water are the substances that chiefly hasten germination. Similar experiments have been carried out by HUMBOLDT, REMOND and NOBBE, but the results were not always in agreement, as the determination of the chlorine was always omitted, and the caustic, corrosive action of chlorine water upon the embryo was not prevented, either when the seeds were immersed in the solution, or when the latter was sprinkled over the soil after sowing. Germination is connected with the transformation of the nitrogenous substances of the seed into more soluble compounds with a smaller molecule. In order to start this process of hydrolysis many factors are required, viz., a certain temperature, percentage of moisture, etc. Since chlorine possesses the property of hydrolising certain organic substances and transforming them into amino-acids, it is able to stimulate germination and take the place of other physical factors, especially in the case of dry seeds in which the nitrogenous substance is not completely destroyed, and which still contain a large amount of water.

The author tried to find some substance that could prevent the caustic action of the halogen gases on the germinating seeds and yet not interfere with the stimulating action. He discovered that vegetable soil after being treated with gas could be employed as a fertiliser on land sown with wheat. This fertiliser, which he calls Clumina, has given satisfactory results. In experimental trials on wheat, the author advises the application of 1 to 2 kg. of Clumina per 100 sq. metres. The fertiliser should nearly all be spread at sowing-time, only a small part (less than ¼), being reserved for dressing the crop before the spring. The author has gassed other substances beside vegetable mould and found that the more nitrogen they contained the higher their fertilising property became. A. C. M.

879. **The Effect of Several Mineral Fertilisers upon the Nodulation of Virginia Soy Beans.**

PERKINS, A. T. (New Jersey Agricultural Experiment Station). *Soil Science*, Vol. XVII, No. 6, pp. 239-447, bibliography. Baltimore, Md., 1924.

The experimental results obtained by previous workers did not agree as to the effect exercised by chemical fertilisers upon the formation of nodules on the roots of the soy-bean. The object of the author's study was to determine this effect when the unknown factors were reduced to a minimum and the known factors were controlled as much as possible.

In the first place, it was found that where there was little or no lime, the application of a fertilising mixture composed of calcium carbonate, sodium phosphate and potassium chloride produced few nodules on the soy-bean roots. This corresponds with the results obtained in the case of other leguminosae.

The study of the isolated action of true fertilisers showed phosphates (acid phosphate) not to be necessary to nodule formation; indeed a large amount of such phosphates had the effect of reducing the number of nodules. Small quantities of potassium (potassium chloride) appeared to promote nodulation, although the figures obtained may be due to experimental error. When the amount of potassium was increased, symbiosis immediately stopped; this was perhaps caused by the excess of chloride or of potassium ions, the rise of osmotic pressure, or some other factor. Practically, potassium is not required for nodulation.

As regards nitrogen (sodium nitrate), the conditions of the experiment prevented any very accurate results being obtained, for it is always possible that atmospheric nitrogen may have been utilised by the plants. However, even if fixed nitrogen is not indispensable for nodule formation, the latter is promoted by small amounts of nitrogen, but inhibited by large amounts.

The presence of calcium is necessary, but the growth of nodules is not increased by adding to the supply of lime.

The inhibiting action of large quantities of phosphates is in direct proportion to the availability of these salts and does not depend on their acidity, or upon osmotic pressure, but must be attributed to some other factor affecting the physiological activity of the plant.

The favourable action of lime is not due to this base counteracting the effect of the root-acidity but rather to the neutralisation of non-acid toxic ions and to the effect exercised by calcium upon the growth of the seedlings.

Under practical conditions, phosphates and potassium may encourage nodulation by counterbalancing the action of some toxic factor (iron, manganese, aluminium), present in the soil. Lime may act in like manner, and further, since it enters into the mechanism of nitrogen fixation, its presence may increase, just as its absence hinders the growth of the young plant. A. F.

Agricultural Botany.

880. Law of the Influence of Different Factors upon Plant Growth.

MITSCHERLICH, A. Das Wirkungsgesetz der Wachstumfaktoren und das Wastumsgesetz der Pflanzen. *Mitteilungen der Deutschen Landwirtschafts-Gesellschaft*, Year XXXIX, Part 12, pp. 214-215. Berlin, 1924.

A distinction must be made between two very important laws of plant physiology: the law of the influence of growth factors and the law governing growth. The first law, as its name implies, teaches us that the yield varies with the increase of one or other of the growth factors, while from the second law we learn that the yield varies with the development of the plant and also with time.

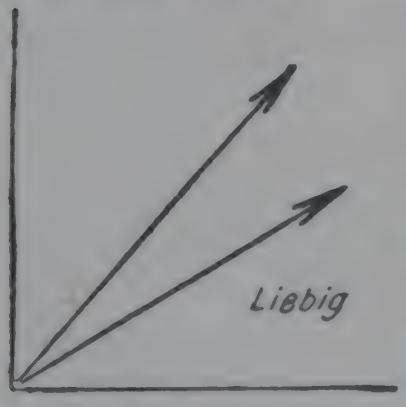


FIG. 127. — Curve of Liebig.

The increased yield due to the influence of a single factor can be studied by simply varying this factor and keeping all the other factors unchanged. Under these conditions, the yield of a plant increases with the addition of fertilising substances and according to a fixed law, the law of the influence of the growth factor, which may be expressed as follows: Every increase in yield is proportionate to the difference between the maximum yield it is possible to obtain and the yield already obtained, and this until the maximum yield is obtained. If we take 100 as being this maximum yield and suppose that the first application of the fertiliser has produced 50, there is then another 50 to be made up. A second and equal dressing will give an increase of 25; we are then still 25 short of the maximum yield, but the third application of the fertiliser will give 12.5 etc. The maximum yield is itself limited by the conditions that determine the other growth factors which, as we have said, remain unchanged.

If A be the maximum yield, b the amount of the fertiliser already in the soil, c the effective power of the fertiliser in question, x the amount

of the fertiliser and y the yield to be determined ; we get the following formula :

$$\log. (A - y) = \log. \quad A - c\ (x + b).$$

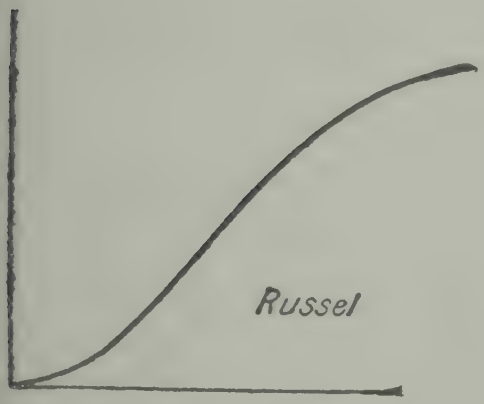
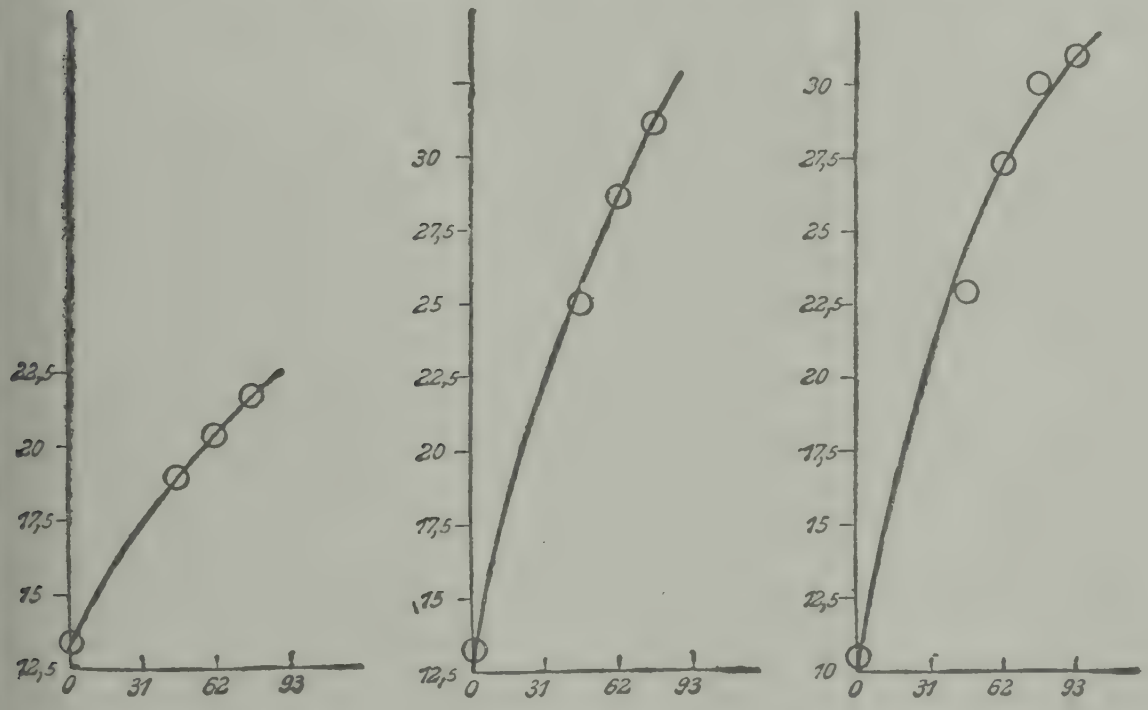


FIG. 128. — Curve of Russell.

FIG. 129. — Curve of Mitscherlich.

The author has plotted curves obtained from experiments made to show the working of this law and, in this way, gives its mathematical



FIGG. 130, 131, 132. — Proof of the effect of growth factors as shown by Darmstadt.

expression. He lays stress upon the complete agreement between the calculated values and those found by the experiment.

The first part of the curve always takes a rectilineal course. Its shape shows that progress is being made towards a maximum yield ;

the curve is always inclined towards the right and has no point of inflexion. This curve proves that the old law of LIEBIG is incorrect. The law of the minimum implies proportionaliy; LIEBIG's law applies to the rectilinear section of the curve, but to no other.

As the curves obtained show, there are never any points of inflexion. RUSSELL's S-shaped curve therefore finds no justification. On the other

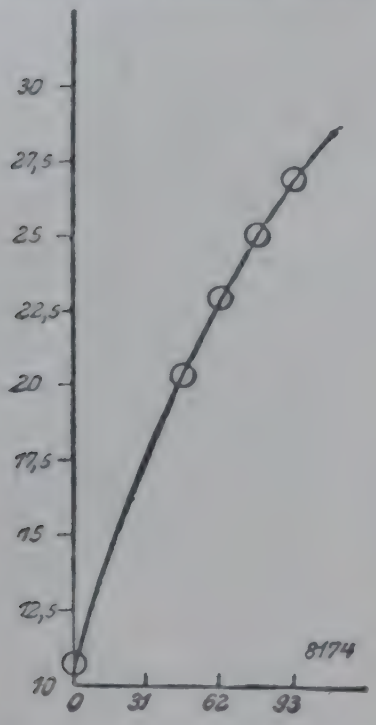


FIG. 133. — Proof of the effect of growth factors as shown by Darmstadt.

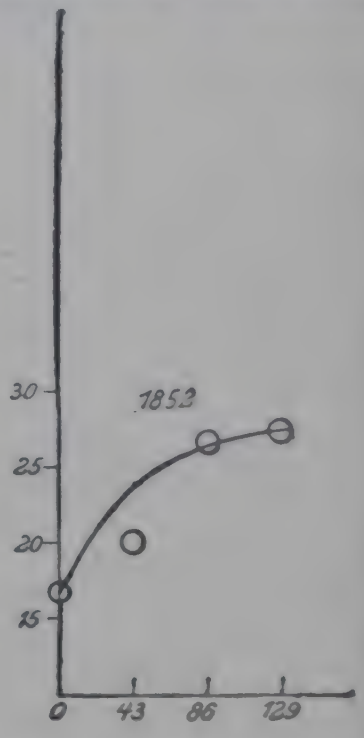


FIG. 134. — Proof of the effect of growth factors as shown by Darmstadt.

hand, a curve of this kind is obtained when two growth factors vary at the same time; water, light, heat, for instance, may be the second factor. A fertiliser with double action, such as ammonium superphosphate, can have the same effect.

Since during the period of development, all the growth factors come into play in the course of time, the second law, that of plant growth, clearly reveals its working by an S-shaped curve. The author announces the appearance of a series of studies on the law of plant growth. R. D.

881. The Relative Importance of the Carbon Dioxide of the Soil and of the Atmosphere in Plant Growth.

REINAU, E. H. Der Anteil der Bodenburtigen und der atmosphärischen Kohlensäure in Ackerbau. *Die Technik in der Landwirtschaft*. Year 3, No. 4 pp. 95-103, figs. 4, tables 2. Berlin, 1924.

The author refers to his earlier studies, begun in 1911, on the effect of carbon dioxide on plant growth. In the course of these investigations,

he devised a small manure distributor for « O C O » which is used to great advantage in greenhouses by many gardeners.

Data are given showing the considerable variations in the carbon dioxide content of the atmosphere according to the hour, the level at which the air samples are taken, the season, amount of light, direction of the wind and the temperature. Thus, for instance, in the same place, shortly before dawn, the carbon dioxide content of the air was found to be 216/100 000 as against 29/100 000 in sunny, windless weather at midday. The nearer the soil the air sample is taken, the more CO_2 it contains, due to the microorganisms of the soil. At 5.40 p. m., 28/100 000 of CO_2 were found 160 cm. above soil level as against 68/100 000 at the same hour, but at a height of only 30 c. This last figure was only obtained in the open at 8.27 p. m. Although at 8.50 p. m. on a level with the foliage, only 136/100 000 were recorded, this figure rose to 198/100 000 a quarter of an hour later as a result of the cessation of assimilation. The variations in the CO_2 content of the air at 80 cm. from soil level are given, together with the variations of the temperature recorded at the same time.

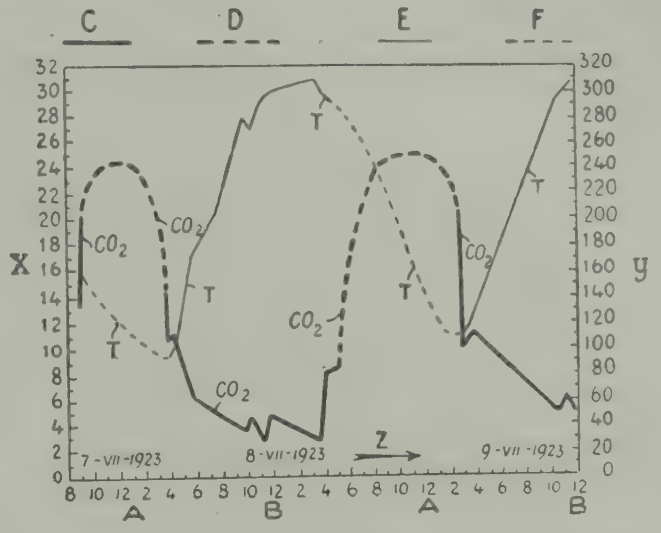


FIG. 135. — Variation in content of carbonic anhydride at 80 cm. above soil level, dependant upon variation in temperature.

A = midnight; B = midday; C —— = average value of atmospheric CO_2 at level of leaves 80 cm. above soil; D - - - - - = calculated value of atmospheric CO_2 under normal conditions; E —— = variation of temperatnre during the measurements; average value, F - - - - - = *idem*, calculated value; x = temperature; y = CO_2 in 100 000 l.; z = data.

During the whole vegetation period, the soil liberates CO_2 to the extent of 1 gm. per square metre and per hour. The atmosphere is a constant reserve of carbon dioxide, 100 000 litres of air containing about 30 litres of CO_2, while at soil level, many estimations have shown that 100 000 litres of air often contain as much as 200 litres CO_2.

The CO_2 of the air and the soil may reach the leaves of plants by means of the wind and by diffusion. Under normal conditions, the effect of the wind is negligible because the resistance opposed by the plants stops the progress of the wind as soon as it reaches the edge of the field.

According to BROWN and ESCOMBE, the diffusion is regulated by the following law. In the case of a CO_2 content of 1/100 000 and at a height of 1. cm., 0.130 gm. pass over one square metre of surface in 1 hour. From this it can be deduced that most of the CO_2 supplied to plants comes from the soil rather than from the air, owing to the great difference of the CO_2

content at the two levels and the close proximity of the leaves to the soil.

These theories have been confirmed by vegetation experiments. The CO_2 content of the air was measured by an apparatus specially constructed for the purpose by PETTERSON and SONDEN, and described by the author. The samples were taken at the following levels : *a*) near the soil, but sufficiently high to prevent the sample absorbing any of the air from the soil ; *b*) at the level at which the leaves being well illuminated can assimilate CO_2 freely ; *c*) from 1.5-2.5 metres above the soil, that is the say in the normal air. The rapid variations in CO_2 content made it necessary to take the three samples at the three levels as quickly as possible. The special apparatus was devised for the purpose of mekting these requirements.

Some estimations made in absolutely closed greenhouses may here be mentioned. On a very bright day in August 1922, a very low CO_2 content of 14/100 000 was found ; 6 tablets of "OCO" (= to 600 litres of CO_2) were introduced by means of the manure distributor which raised the carbon dioxide content of the air to 80/100000 so that the leaves which had ceased assimilation resumed their usual activity, The average CO_2 content in the greenhouse was 50/100 000 ; it fell to 30 and even 20, in bright sunshine and rose to 130 in the dark. The part played by the sun in supplying CO_2 is clearly shown by the following results obtained with the "OCO" distributor. In a greenhouse where the floor was either made of cement, or trodden down hard, there was, in addition to a few pot plants, a vine-branch that belonged to a stock growing outside and had dragged out a miserable existence for 15 years and was completely barren. The author gave 100 litres of "OCO" twice a day for this vine-branch, which then produced normal leaves, and for the first time for many years bore fine grapes. This is explained by the fact that the branch received no CO_2 from the hard, or paved, floor, while any given off by the soil in the pots was absorbed by the pot plants themselves. Other food substances such as salts and water were supplied to the vine-branch from its roots that ran underground. In another table, the author gives a large number of data from recent experiments made on the CO_2 content of air in the open ; the conditions of the experiments, crops, cultural operations, fertilisers, nature of soil, moisture, temperature, wind, insolation, level at which sample was taken etc., being also recorded. From these data it is seen that at the level of the leaves, in full daylight, a very distinct minimum is observable ; the maximum is found at the level of the soil, while in normal air above the plants there is an intermediate value between the maximum and

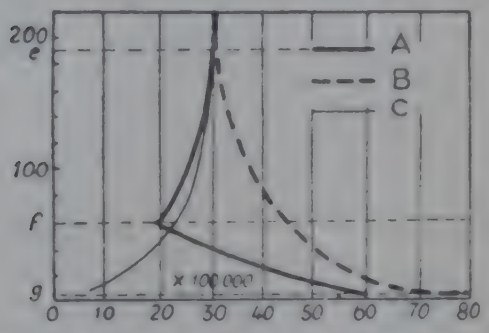


FIG. 136. — Content of carbonic anhydride in the atmosphere at soil level, at the level of the leaves and in the normal air above the plants, according to the author, Bornemann and former conceptions.

A = Dr. REINAU ; B = Dr. BORNEMANN ; C = former methods.

minimum. On the basis of these observations the following remarks may be made (see fig. 136) :

A. If there were any justification for the views of the old school which are still held by MITSCHERLICH and LEMMERMANN, who maintain that the atmosphere is the sole source of the CO_2 supply of plants, we should have the finely drawn curve where the maximum CO_2 content is in the air and the minimum in the soil.

B. If the soil alone supplied CO^2 to plants as VORMEMANN believes, we should have the dotted curved where the CO_2 content falls on leaving the soil (maximum) and continues decreasing till it reaches the air (minimum).

C. As a matter of fact, the curve takes the course marked out by the thick line and the minimum is reached at the level of the leaves.

Thus, the air and the soil both play their part is supplying carbon dioxide to the leaves, but as is shown by the figures in the tables, and by the author's calculations, the soil is the chief source of this gas. On an average, it may be said that the amount supplied by the air is not 1/10 of that supplied by the soil.

Thus, the soil is the important source of CO_2 from the economic point of view and for farm crops. Calculations based on experiment show also that the soil is able to provide all the CO_2 required by plants.

This important conclusion justifies the interest attaching to all investigations directed to the determination of how far the carbon dioxide production of the soil is affected by methods of cultivation, fertilisers, and the nature of the soil. R. D.

882. **The Effect of Hydrogen Ions and Neutral Salts Ions upon the Germination and Development of Wheat.**

LUNDEGARDH H. (Ökologische Station von Hallands Väderö, Sweden). Über die Interferenzwirkung von Wasserstoffionen und Neutralsalzionen auf Keimung und Wachstum des Weizens. *Biochemische Zeitschrift*, Vol. 140, Parts I and II, pp. 217-225, diagrams 5. Berlin, 1924.

The author mentions the results of his first experiments showing the alteration produced in the action of the hydrogen ion by the presence of the calcium and the ammonium ion.

The injurious effect of the hydrogen ion is partly counteracted by the above ions, but seems to be increased by the aluminium ion.

In his experiments with calcium chloride, the author found that plants growing in slightly acid soil are very susceptible to even small variations in the amount of calcium chloride supplied (see fig. 137). The fact that very small quantities of calcium suffice to weaken perceptibly the action of the hydrogen ion present, is of great importance for the cultivation and geographical distribution of plants. It is probable that the effects of liming, which have hitherto been attributed to the neutralisation of injurious acids, are partially due to the counteraction of ions.

The author has carried out other experiments with potassium chloride and sodium phosphate. The action of sodium phosphate is similar to that

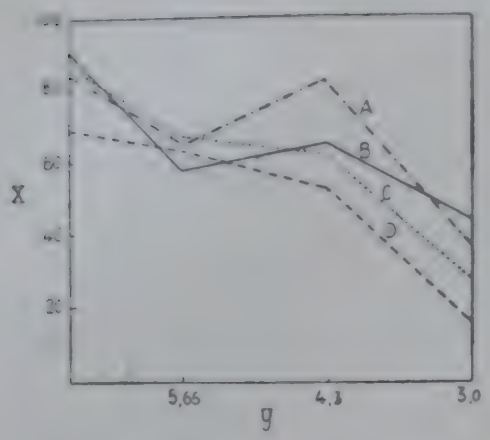


FIG. 137. — Curve P_H of growth.
X = yield; y = P_H; A = + 5.0 cc. $CaCl_2$ n/10; B = + 0.5 cc. CaCl; C = without salts.

of calcium chloride in as far as it is greatest in soil with a distinctly acid reaction. Potassium chloride has an energetic action upon plant growth in slightly acid soils and there is no doubt that 5.6-4.3 % of sodium phosphate has an active effect in counteracting the toxic action of the hydrogen ion.

The author then refers to his studies on the effect of the concentration of the hydrogen ion upon the germination of wheat. He divides the grains into three classes according to their germination. The results of these experiments showed that the hydrogen ion has relatively a very slight effect upon the vitality of seeds, but that its action is chiefly confined to reducing the speed of certain growth processes during germination and especially to retarding root development.

The effect of the salts upon germination naturally extends to the whole crop and the very light weight of wheat grown on strongly acid soils appears to be due to poor germination. In normal soil (P^H 5.65 - 4.5) the favourable action of the salts upon developement is clearly shown, although their action on germination appears less (see figs. 139 and 141).

The author attributes the action of neutral salts upon the hydrogen ion, a phenomenon of general occurrence, to the effect of the well-known antagonism between the cations and anions of neutral salts.

The fact that ammonium chloride, potassium chloride and sodium phosphate are all antagonistic to the hydrogen ion is of great importance to plants, since these compounds are always present in the soil and are indispensable components of the nutritive substances required by the plant organism.

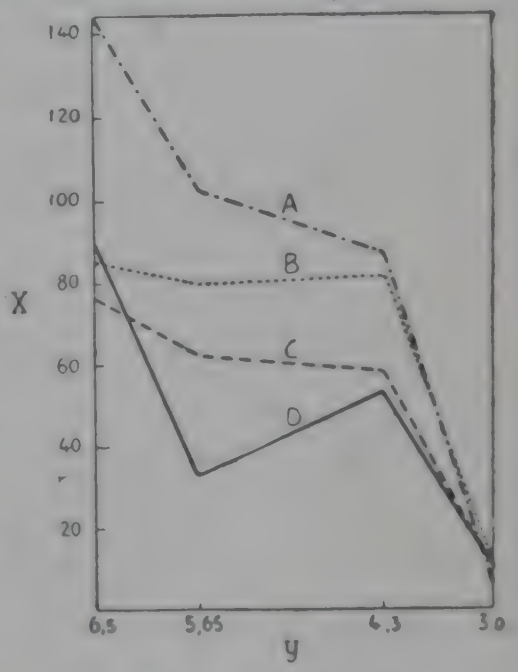


FIG. 138. — Curve P_H of growth.
X = weight of yield; y = P_H;
A = + KCl; B = + NaH_2PO_4;
C = $CaCl_2$ — D = without salts.

The conditions obtaining in ordinary soil are not as simple as those produced in the laboratory. Under natural conditions, a strong concentration of the hydrogen ion is always accompanied by the presence of the ion of aluminium which according to same authors, is responsible for the tox-

icity of acid soil. The beneficial action of certain salts can thus be explained by their counteracting the effects of both the hydrogen and the alumin-

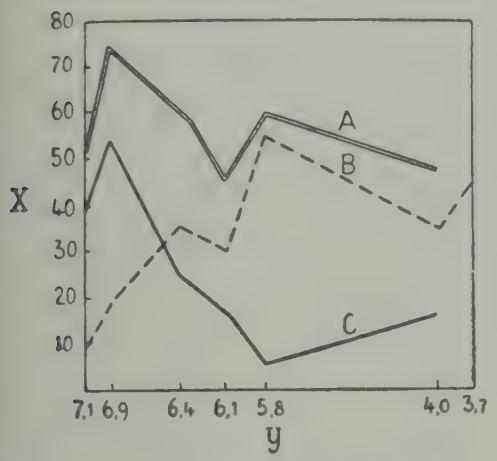


FIG. 139. — Curve P_H of germination of wheat in water.
X = percentage of germination ;
y = P_H ; A = summer curve ;
B = incomplete germination ;
C = complete germination.

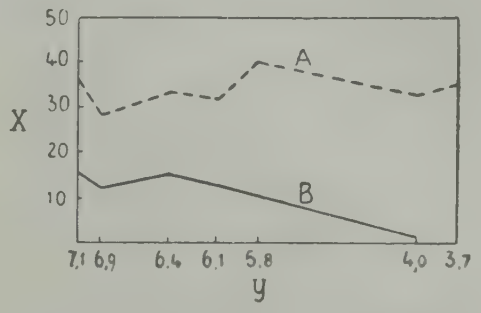


FIG. 140. — Curve P_H for germination ; N/2000 $CaCl_2$.
X = percentage of germination ;
y = P_H ; A = incomplete germination ;
B = complete germination.

ium/ion. It is thought by some scientists that acid phosphates have the power of neutralising the toxic action of the aluminium ion to a certain extent. Any similar effect due to liming must be attributed to the calcium decreasing the solubility of the aluminium and thus indirectly increasing the action of the hydrogen ion.

So far, it has been assumed by many observers that the hydrogen ion is the dominant factor in plant distribution. From what has just been said, it is evident that the action of the hydrogen ion depends on the presence of salts in the soil. Hence we should not expect that soils containing the same amount of hydrogen ions, will necessarily support the same vegetation.

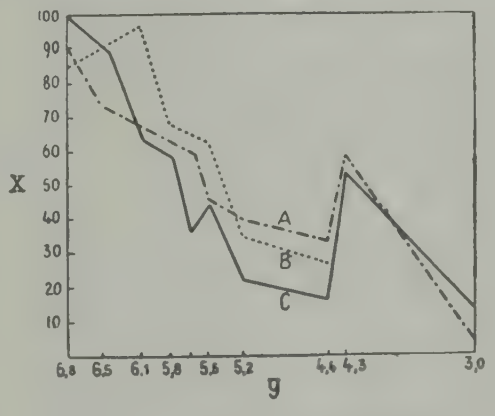


FIG. 141. — Curve P_H for germination (corresponding to 16 fig. 138).
X = percentage of germination ; y = P_{H4} :
A = + KCl ; B = without salts ;
C = NaH_2PO_4 D = + $CaCl_2$.

Plant growth depends not only upon the actual concentration of the hydrogen ion, but also upon a number of other factors whose action interferes with that of the hydrogen ion.

G. B.

883. **Artificial Illumination of Plants.**

MENEGATI, O. L'Illuminazione artificiale notturna è un mezzo per accelerare le fasi del ciclo dei vegetali. *Atti della R. Accademia Nazionale dei Lincei*, Vol. XXXIII, No. 10, pp. 402-405. Rome, 1924.

The author carried out a series of investigations to ascertain whether the life of a plant could be prolonged by placing it under the most favourable conditions for ripening the seeds when further development was checked by the cooler, shorter days of autumn. Some plants in the open, which would have perished from the autumn cold before ripening their seeds, were covered with a glass shade in which was introduced an electric lamp of 60 candle-power. The lamp was intended to serve as a source of light and heat by night and as a source of heat on cold foggy days. During the night the glass shade was covered with an impermeable cloth to reduce the loss of heat as far as possible. The experiment proved very successful, for the stools of wheat cultivated under these conditions grew 2-3 cm. in 24 hours and some bore ears in full flower on the thirty-fifth day. The experiments were continued in the greenhouse, and here again the results exceeded the author's expectations. The plants were subjected to intense and continuous illumination (a total of 4000 candles over an area of 5 sq. metres) at air temperatures ranging from 20-35°C. and soil temperatures of 17-23°C (see Table LVII). The stages of development were certainly hastened to an extraordinary extent by these forcing conditions.

A. C. M.

Plant Breeding.

884. **Maize Selection and Relation of Type and Moisture Content to Yield and Resistance.**

KIESSELBACH, T. A. Productive Seed Corn. *Bulletin 188 University of Nebraska. College of Agriculture Experiment Station*, pp. 1-35, figs. 7, tables 9. Lincoln, 1923.

A survey is made of the annual production of maize in Nebraska, the effect of climate on yield, the relative productivity of local and imported varieties and the adaptation characteristics of acclimatised types. According to the tests carried out at the Nebraska Experiments Station, it appears that a definite improvement is probable from selecting a longer, more slender, smoother type of seed ear, with horny and shallow kernels, which gives a smaller and earlier maturing plant, more easily acclimatised. Tests made to determine the comparative resistance to rot diseases, confirmed previous results to the effect that the smoother types are more resistant. Experiments covering a 5 year period were made to compare the effect of different plant characters on yield. It has been concluded that seed from the various parts of the ear yield about the same and that little is to be gained by discarding tips in preparing seed maize.

As regards correlation between seed maturity and yield, seed which has reached the denting or glazing stage if properly cured, is ready for sowing under any circumstances.

PLATE LVII.

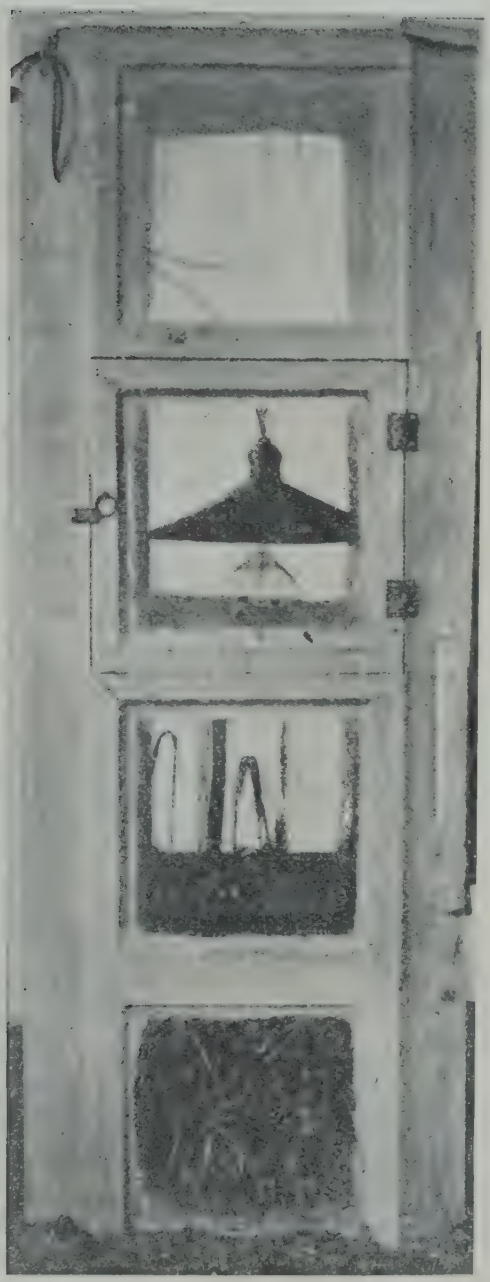


FIG. 142. — Large glass container with wheat plants exposed to intense artificial illumination in the evening. (Ears ripened in December 1923).

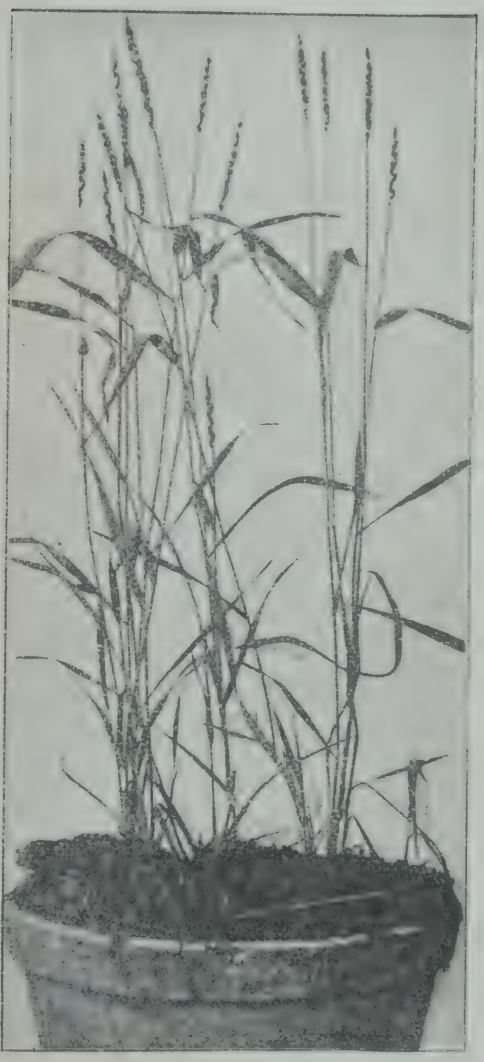


FIG. 143. — Wheat plant with ripe ears on the 60th. day after sowing (sown 10th January) under glass artificially illuminated after dusk.

A detailed description is given of the breeding tests made to determine the effect of time of selection and preservation of seed maize on the yield ; ear-to-row breeding ; effect upon seed value of selecting ears from detasseled plants ; production of pure lines ; the effect of the planting rate on yield ; the relation of uniformity of stand to yield. From tests it has been concluded that the smaller and earlier maturing sorts should be planted at a relatively thicker rate, and that for larger varieties a considerable irregularity in the stand has no marked effect on the yield.

Special investigations are reported concerning the correlation between frost injury and moisture content of the seed. From the results obtained it is evident that the higher the moisture content the less the resistance to frost. Germination ceased entirely with a 60 % moisture content, at a temperature range of 32°-28°F., and injures were apparent with a 25-30 % moisture. This proportion is followed relative to decrease in temperature and moisture percentage. Below 14 % moisture, air dried maize will resist a low winter temperature indefinitely. The accompanying chart shows clearly the comparative resistance, and demonstrates also the importance of air-drying the seed, and that in comparing maize yields, moisture content and shelling percentage are factors of practical consideration. M. L. Y.

885. **On Inheritance of Leaf Color in Purple Rice-Plants.**

Takozaki, Yoshinobi, Murasakiine no Yoshoku Iden ni tsukite. *Japanese Journal of Genetics*, Vol. 1, No. 1, pp. 37-43, illus. May, Nishigahara, Tokio 1922 (Japanese).

Purple coloration of certain varieties of rice-plant is due to the presence of anthocyanin pigment all over the plant tissues. The cross between purple rice " Murasaki " and green " Fusakichi " and that of " Murasaki " and " Bokusukegawari " (green) resulted in all purple, the character being dominant to green. The segregation of purple and green individuals in F_2 generation was in both cases approximately 27 purple and 37 green. thereby proving that it requires three homologous factors *A*, *B* and *C* to represent the purple coloration of the mother variety " Murasaki ". Theoretically, one portion out of 27 purple plants will remain constant in the succeeding generation, and six portions will show segregation of 3 purple and 1 green, while 12 portion will split into 9 purple : 7 green, and the remaining 8 portions will break up into 27 purple and 37 green. This expectation was satisfactorily proved by application of the curve analysis method in the examination of segregated members of F_3 generation.

In the second paper, a report was made on results of crosses between green individuals from the fifth generation of an original " Murasaki " and " Fusakichi " cross. Two green individuals were chosen as indicators, which previously segregated 3 purple : 1 green in the F_4 generation. The hybrids were all purple and the next generation showed 9 purple : 7 green. This proves that the original indicator parents were of constitution *AABBcc* and *AAbbCC* (or *aaBBCC*) respectively, because they

were recessive individuals from monohybrid hetero purple. The cross therefore brought a dihybrid segregation.

One of these indicators was crossed with 15 green individuals which were selected from individuals segregated in proportion 27 purple : 37 green. Thereotically the latter are individuals of various genetic constitution different in 19 possible ways, i. e. *AABBcc*, *AABbcc*, *AaBBcc*, *AaBbCC*, *AAbbCC*, *AAbbCc*, *AabbCC*, *AabbCc*, *aaBBCC*, *aaBBCc*, *aaBbcc*, *aaBbCc*, *AAbbcc*, *Aabbcc*, *aaBBcc*, *aaBbcc*, *aabbCC*, *aabbCc*, *aabbcc*. Theoretical segregation in the next generation must be 14 purple : 23 green. 8 portions out of 14 purple must show dihybrid segregation in the succeeding generation, and the remaining 6 portions must offer trihybrid segregation. The experimental data were, 21 purple : 57 green (approximately 10 : 27), and the ratio of two classes of purple individuals were 13 : 6 (approximately 12 : 4). These figures accord roughly with what was expected.

In conclusion, the repeated experiments proved that the purple character of rice plants requires three homologous factors acting together, and the lack of any one of these factors results in green individuals.

T. T.

886. **On Inheritance of Brown Color of Rice Grain.**

KATO SHIGEKANE and ISHIKAWA, JUN'ICHI. Akamai Shikise no Iden ni tsukite. *Japanese Journal of Genetics*, Vol. 1, No. 1, pp. 1-7, Nishigahara, Tokio, May 1922 (Japanese).

There are three kinds of white polished rice, genetically of different constitution. Wase Shinriki and Genkimochi (both white) are represented by the factor B, while another white variety Obamochi is BC, the factor C being a whitening factor for A, brown pigment of seed coat, thereby causing Shiro Toboshi (AC) to be white. A brown rice called Kuromoro (ABC) crossed by white Obamochi (BC) resulted in a brown rice, segregating in F_2 3 brown and 1 white. The same variety crossed with white Wase Shinriki (B) produced also a brown rice, but the segregation which took place in the succeeding generation showed 9 brown (ABC), 3 yellowish brown (AB) and 4 white (AB and C). Pure yellowish brown rice (AB) was then isolated and crossed with white Shiro Toboshi (AC) which resulted in producing brown F_1 generation (ABC). The cross between white Wase Shinriki (B) and white Shiro Toboshi (AC) also produced brown offsprings (ABC). White F_1 was however obtained by crossing white Obamochi (BC) with white Genkimochi (B).

T. T.

887. **Sterilities of Wild and Cultivated Potatoes with Reference to Breeding from Seed.**

STOUT, A. B. (Director of Laboratories, New York Botanical Garden) and CLARK, C. F. (Office of Horticultural Investigations, Bureau of Plant Industry). *U. S. Department of Agriculture, Department Bulletin* No. 1158, pp. 1-31, tables 6, plates 8, bibliography. Washington, D. C., 1924.

The importance of breeding potato varieties resistant to disease is emphasised, but in view of the difficulties encountered in the marked

sterility in seed so often observed, the authors have made a special study of the several types of sterility, and the viability of the pollen, as a basis for further investigations.

The experiments include a study of sterility due to non-flowering ; sterility of hybrids, which affects both male and female organs ; the one-sided sterility or abortion, and sterility due to incompatability in cultivated varieties and in wild species. There is positive evidence of such sterility in the wild species, *Solanum chacoense.*

Pollen in anthers of fully mature flowers of any variety appears to be very constant in quantity, range of abortion, general character and viability. The production of tubers in which much food is stored does not directly influence and prevent the formation of fruit. M. L. Y.

888. **Pollination of Cherry-trees.**

FLORIN, R. Korsbärstradens Pollinering. *Sveriges Pomologiska Förening Aroskrift*, pp. 173-204. figs. tables and bibliography. Stockholm, 1923.

The author reviews the works published on the pollination and fertilisation of cherry-trees. He refers especially to the researches made on these subjects in Sweden and quotes the results obtained.

It has been found that only well-defined varieties of cherry with known reaction to pollination should be grown in nurseries.

All varieties of sweet cherries and most other varieties are self-sterile. Trees for pollinating must be planted in the case of nearly all varieties that are of importance from the economic standpoint.

The origin of the trees supplying the pollen must in all cases be known.

Sterile Kentish varieties should be replaced by completely self-fertile kinds, such as the Stora Klanbär of the Svenska Tradgardsförening.

During the flowering season, the visits of a large number of bees should be assured in order that the pollen may be properly distributed.

R. D.

889. **Bud-Variation in the Japanese Sand Pear and Oriental Peach.**

ENOMOTO, NAKAE & KAKIZAKI, YOICHI. Nashi oyobi M mo ni okeru Gajö Hen'i. *Japanese Journal of Genetics*, Vol. 1, No. 2, pp. 107-116, illus., bibliography. Nishigahara, Tokyo. 1922 (Japanese).

Cases of bud variation in an individual of the " Chojuro " variety of Japanese sand pear and also of " Rikaku " (free stone) oriental peach were reported. The new features of bud-variation in the former case, which are successfully propagated by grafting, are enumerated as follows : (1) leaf larger and petiole shorter, (2) number of flowers few, petals larger and longer, pedicel longer and thicker, both filament and style longer, greater number of filament and marked abundance of pollen, (3) quicker increase of size and especially that of breadth of the young fruit, (4) many differences in characters of mature fruits, i. e. broader in shape and heavier, maturing slightly later, cavity broader and deeper, flesh more

yellow, more juicy, less gritty, less rich in sweetness and in flavor. The new bud-variation " Rikaku " matures about two weeks earlier than the mother variety and no other difference was noted. The variation was also successfully multiplied by vegetative propagation in the latter case, as in the former.

T. T.

Seeds.

899. **The Effect of "Uspulun" upon Germinating Seeds.** (1)

CZARNOWSKI, S. Przyczynek do poznania działania Uspulun na kiełkujące pszenice, *Roczniki nauk rolniczych*, Year XI, No. 1, pp. 52-62. Poznan, 1924.

The agricultural Press appears to be of opinion that " *Uspulun* " not only sterilises seeds without causing injury, but also increases their germinating capacity. In these experiments, a solution of only 0.5 % was used since experience had proved this concentration to give certain results so far as the destruction of the cryptogamic spores adhering to the seeds was concerned. A study was made of the effect exerted by "Uspulun " upon : the amount of carbon dioxide liberated by germinating seeds, the weight of the rootlets and plumules of germinated sterilised and unsterilised seeds, the energy and germinating capacity of sterilised and unsterilised seeds, and finally upon the inurious action of washing sterilised seeds with water. The wheat-seed used in these experiments was that of the spring variety Marquis ottava 16.

1) The rootlets and plumules of seeds sterilised with a 0.590 solution of " *Uspulun* " were smaller and weighed less than seeds that had been kept in water for the same time without any sterilisation with " *Uspulun* ". Hence, the sterilised seeds made less use of their reserve substances than the unsterilised.

2) Although " *Uspulun* " reduced the percentage of seeds germinating after 3 days, the percentage of those germinating after 10 days was not affected.

3) The amount of carbon dioxide given off by 100 sterilised seeds during germination was less than that liberated by 100 unsterilised seeds. On the other hand, the weight of the carbon dioxide given off (calculated as % of the weight of the rootlets and plumule) was less in the untreated than in the treated seeds.

4) If seeds treated with " *Uspulun* " are washed in water, it increases the amount of CO_2 liberated, which becomes nearly equal to the quantity given off by the unsterilised seeds. This washing, however, did not increase the weight of the rootlets and the plumules, which grew less in the case of the unsterilised than in that of the sterilised seed.

A. C. M.

(1) See *R.* 1923, No. 140. (*Ed.*)

891. **A Method of detecting Mixtures in Kanred Wheat Seed.**

JOHNSTON, C. O. and BOWER, C. W. *Journal of the American Society of Agronomy*, Vol. 16, No. 7, pp. 467-470, bibliography. Geneva, N. Y., 1924.

Although field inspection and certification of seed has been well developed in recent years, the necessity for an accurate method of detecting mixtures in threshed grain has been recognized. Under normal conditions for example, the Kanred wheat has been readily distinguished from other varieties of hard red winter wheat by the length of the beaks on the outer glumes. When affected by drought or other abnormal growth conditions, the difference may, however, not be noticeable. To overcome this difficulty experiments have been made to study the reaction of Kanred and other varieties to certain strains of stem rust (*Puccinia graminis tritici*, Erikss). and Henn.).

The results obtained from inoculation of seedlings show the reliability of this test as a good index of purity, which should prove valuable for field inspection, seed firms, etc. M. L. Y.

892. **Effects of the Modified Hot-Water Treatment on Germination Growth and Yield of Wheat.**

TAPKE, V. F. (Pathologist, Office of Cereal Information, U. S. Dept. of Agriculture). *Journal of Agricultural Research*, Vol. XXVIII, No. 1, pp. 79-98, tables 18, plates 5. Washington, D. C. 1924.

The growth in the use of the modified hot-water treatment for control of loose smut of wheat (*Ustilago tritici* Pers.), caused inquiries concerning the effects of the treatment on the germination, growth and yield of wheat. The available literature did not fully answer the questions and the author, in consequence, carried out a series of investigations to supply the information. During the work it was noticed that seed coats were frequently broken, owing to injury received in machine-threshing.

Seed germination tests carried out on moist blotting paper cannot be used to determine accurately the effects of treatment on germination of seed when sown in soil.

The hot-water treatment reduced germination of wheat seed to nearly zero when the seed coats were broken over the embryo. Reduction also occurred when the seed coat was broken over the endosperm.

Seeds with unbroken coats were retarded by treatment, but there was little or no reduction in germination.

Widely different weather conditions during the period between ripening and harvesting of seed had a marked effect on the amount of injury sustained by seed coats in threshing, and hence in the injury sustained by the seed from treatment.

The bushel weight of wheat grown from heated seed was not appreciably greater than that grown from untreated seed.

In each of the three years of the experiment, wheat grown from untreated seed outyielded that grown from treated seed.

W. S. G.

893. **Sorting Maize Seeds According to their Specific Gravity.**

Selecção do milho o processo do Professor Hottinger. *Revista da Sociedade Rural Brasileira*, Year V, Nos. 49-50, p. 219, fig. 1. São Paulo, 1924.

In the field belonging to the Serotherapic Institute of Butantan (State of São Paolo, Brazil), a 40 % increase in the maize crop has been obtained by adopting the seed-sorting method devised by Prof. HOTTINGER of the Polytechnique School of São Paolo. This method consists in the use of a solution of calcium chloride for separating the light from the heavy grains, which are alone suitable for sowing. F. D.

894. **Determining the Seeds of Species of *Vicia* L. from the Proportionate Length of the Hilum.**

SWEDERSKI, V. O określaniu nasion gatunków VICIA L. weedlung wielkósci znaczka. *Roczniki nauk rolniczych*, Year XI, No. 1, pp. 44-51. Poznan, 1924.

The author investigated the ratio between the length of the hilum and the circumference of the seed in the case of 52 species of vetch, with the object of deciding the question whether this propostion would be of some help in distinguishing the seeds of the different species of vetch which are exceedingly difficult to know apart owing to their great external similarity.

A micrometric screw was used in taking the measurements and the matter was treated in a strictly mathematical manner, the formula of L. L. BORTKEWICZ being used for the purpose. Since the relation between the extent r (the length of the hilum in the species in question), the number of individuals in the lot examined, n, and the mean deviation is :

$$\frac{\mu}{\sqrt{}} = \frac{n(n-1)\sqrt{2}}{\pi} \int_0^{\infty} e^{-2x^2} \left| \left(\frac{1+\Phi x}{2} \right)^{n-2} + \left(\frac{1-\Phi x}{2} \right)^{n-2} \right| dx$$

$$\Phi x = \frac{2}{\sqrt{\pi}} \int_0^{x} e^{-t^2} dt$$

Positive results were obtained in the case of a series of species of vetch, therefore the method of determining species from the length of the hilum must be regarded as having a certain amount of practical utility, since the ratio between hilum length and the circumference of the seeds appears to be a characteristic feature in vetches. A. C. M.

895. **Influence of Temperature and Initial Weight of Seeds upon Growth-Rate of *Phaseolus vulgaris* Seedlings.**

RUDOLFS, W. *Journal of Agricultural Research* Vol. XXVI, No. 11, pp. 537-529, Washington, 1924.

For the purposes of this experiment a large number of beans were taken and arranged according to their initial weight. The small seeds weighed

from 6.92 to 7.3 gm. per 50 seeds ; the large beans weighed 13.52 - 14.41 gm. per 50. The beans were sown in soil of which the moisture was kept at 60 %. As soon as they germinated, they were covered with a thin layer of soil and placed in incubators kept at 5°, 10°, 15°, 20°C. The longitudinal growth of the stems and their internodes was measured daily, and generally at the same hour and on the same specimens, until the seedlings ceased growing and withered. The greatest height attained by the seedlings was almost 28 cm. (at 20°C.), and the minimum was below 2. cm. (at (at 5°C.).

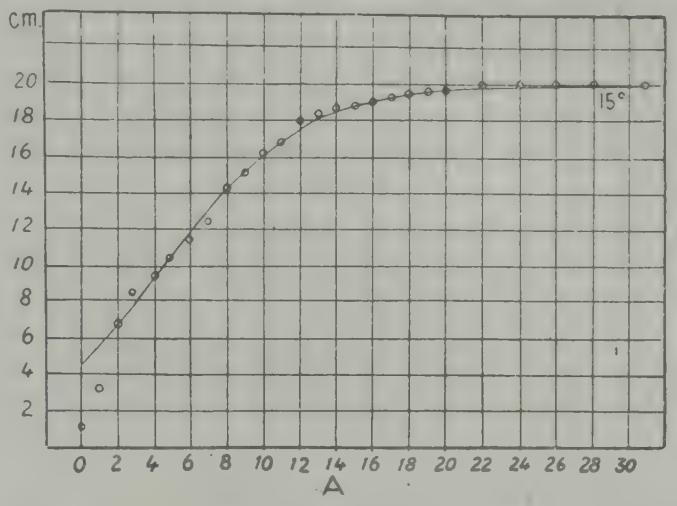


FIG. 144. — Growth rate of shoots of *Phaseolus vulgaris* kept at constant temperature of 15° C.
The curve represents the fitted graph and circles represent the observed lengths.

The autocatalytic formula of ROBERTSON was used $\log \frac{x}{a-x} = K\ (t - t)$, in which a is the height finally attained by the seedling, x is the height after the lapse of the time t; t is the time the seedling takes to reach half its final height, and k = constant.

Figure 144 shows the values observed and the growth curve in the case of large beans (13.71 gm. per 50 seeds) that have grown in a constant temperature of 15°C. These figures agree with the calculated figures, except as regards the beginning of the experiment.

In figure 145 are given the curves showing the different dimensions of the seeds and the different temperatures.

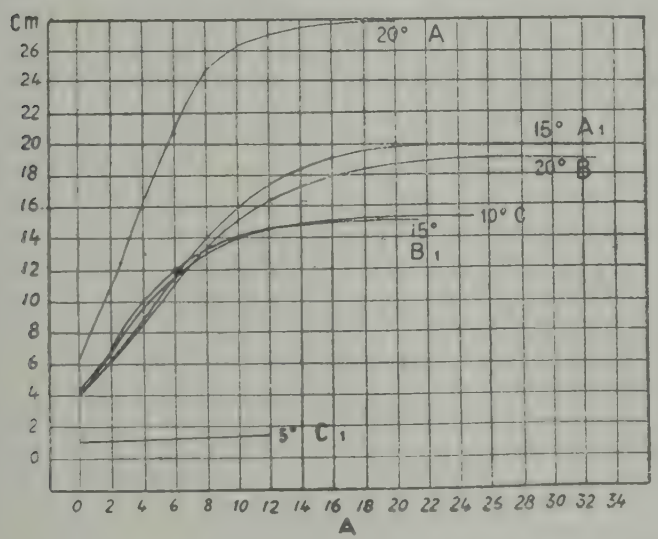


FIG. 145. — Growth rate of shoots of beans kept at different constant temperatures. The curves for beans grown at 15-20° C. represent two different groups of seeds with different initial seed weights.

A = large ; B = small ; C = both.

The total average for seeds of various sizes grown at 5°C and 10°C. are shown by two curves, while the data relating to the small and the large seeds grown at the temperatures of 15° and 20°C.) are calculated separately and given in different curves. It is to be observed that there was hardly any increase in growth at 5°C., the average amount of growth took place in all the seeds at 10°C. and in the case of the small seeds, was almost the same at 15°C. The curves of the seedlings grown at 15°C. and 20°C. prove that the plants produced by the heaviest seeds make the most growth. Seedlings grown in darkness ceased developing as soon as the reserve material present in the seeds was exhausted. The influence of temperature on growth-rate curves is very marked especially in the case of large seeds.

A. C. M.

896. **The Effect of Sunlight on the Germination of Papaya Seeds (*Carica Papaya*).**

MORADA, E. K. *The Philippine Agricultural Review*, Vol. XVII No. 1, pp. 21-23, Tables 2. Manila, 1924.

An experiment was made with ripe fruit of Hawaiian papaya (*Carica Papaya*) to ascertain how much sunlight is required for the germination of the seeds. Results indicate that one half day of sunshine and partial shade gives the most satisfactory results, but too much sunlight proves detrimental, and seeds under total shade will not germinate.

M. L. Y.

897. **A Viability Test for some Tropical Seeds.**

TOLENTINO, A. *The Philippine Agriculturist*, Vol. XIII. No 3, pp 129-141, tables 3, bibliography. Los Baños, Laguna, 1924.

After a review of the various methods employed for germination tests, the author describes the experiments made in the Philippines to determine whether potassium hydroxide solutions are reliable to test the viability of some tropical seeds, and which parts of the seed are responsable for the decoloration of the solution. Fourteen kinds of seeds were tested, divided into two sections:— colourless and naturally coloured. Results indicate that potassium hydroxide is of distinct value as a practical test reagent. Non-viable seed was found to discolour the solution within a few hours, although due allowance should be made for alteration of colour due to discoloured skin or to internal parts, except the embryo. The test is however, not applicable to naturally coloured seeds.

The normality and time required to test viability varied for the different seeds as shown by the following:— rice (*Oryza sativa*), 0.2 N. solution, 3 hours; maize (*Zea Mays*), 0.2 N. solution 3 hours; squash (round) (*Cucurbita maxima* Duschesne), 0.4 N. solution 3 hours; brown mungo (*Phaseolus calcaratus* Roxb). 0.025 N., 3 hours, lima bean (grey) (*Phaseolus lunatus* L.), 0.05 N., 0.5 hour.

The most common colour of the discoloured solution is yellow or brown, the colour, of dead seeds is either amber or dark brown or a combination of both. The strength of the potassium hydroxide affects the

seeds and in many cases kills them. Seeds having a rigid, hard and colourless skin are, however, more resistant and require a higher normality for their test. The number of seeds that germinate after soaking in the solution decreases as the normality increases, due probably to the corrosive effect of the potash. M. L. Y.

898. **The Preparation and Packing of Seeds and Scions of Trees and Shrubs in the Tropics.**

WESTER, P. J. *The Philippine Agricultural Review*, Vol. XVII. No, 1, pp. 46-51. Manila, 1924.

A grouping of the various trees and shrubs which can be stored dry and still retain their germinative power, and others which will only retain their vitality with moist packing. Recommendations for proper conservation of moisture for exported scions and cuttings are given. Waterproofed bamboo joints have been found satisfactory as containers in the Tropics. M. L. Y.

CROPS IN TEMPERATE AND TROPICAL COUNTRIES

Cereals and Forage Crops.

899. **Influence of Date of Sowing upon Crop Yield of Cereals.**

VIK, K. Satidsforsøk med wärkorn og erter. *Meldinger fra Norges Landbrukshoiskole*, Part 6, pp. 269-336, Tables, figs. Christiania, 1923.

From 1919 to 1923, experiments were made in 26 experiment fields in Norway in order to compare the results obtained by sowing spring cereals at different dates. As might have been expected, no date of seeding proved the best from every standpoint. The straw yield was generally the highest in the case of late-sown cereals, as they obtained a plentiful supply of water during the time when the culms were growing most rapidly. The only exceptions were explained by drought at the time of germination.

On the other hand, the grain harvest is increased by early sowing. The last sown crops (those of May 25 and of June 26) were always less than the others. The autumn frosts injured all the late-sown cereals except the six-rowed barley, so that the yields were decreased. This is an accident that rarely, if ever, befalls the early-sown crops.

The conditions of temperature lengthen the period of germination and prolong the period between germination and heading in early-sown cereals

as compared with later-sown cereals, but the period between heading and maturity is longer in late-sown crops especially if they belong to late varieties, as this period is only reached by the time the maximum heat of summer is over.

Lodging is more to be feared in late-sown crops, because the culms are long at a time when they can least stand the rain.

There is less weed-growth if the cereals are sown at an intermediate date. Cryptogamic diseases (*Ustilago*, *Cladosporium*, rust, etc.) are commonest on late-sown crops. The eelworm attacks early-sown oats and does much damage.

As a rule, early sowing proved more satisfactory on light soils that dry out easily than on heavy soils.

The grain was invariably of superior quality in early-sown crops as the water content of the seeds was lowest. The size of the grain did not vary in the May sowings (5, 15, 25) but the grain of the crops sown on June 4 was in all cases much smaller. The greatest weight per hectolitre was obtained from early sowings and this weight decreased more rapidly than the quality with the lateness of the seeding. Early-sown spring wheat and barley produced grain rich in starch and poor in protein. In the case of the barley, the sum protein + starch remained constant no matter at what date the seed was sown, but in late sown wheat (May 25 and June 4) this sum distinctly decreased on account of the frequently poor development of the grain, while the flower made from late-sown wheat and rye had an unsatisactory appearance and made poor quality bread.

R. D.

900. The Influence of Rainfall on the Yield of Wheat at Rothamsted.

FISHER, R. A. (Head of Statistical Dept., Rothamsted Experimental Station). *Philosophical Transactions of the Royal Society of London*, Series B, Vol. 213, pp. 89-142, Figs. 10, tables 14, bibliography. London, 1924.

The article is a study by a mathematician of statistics relative to rainfall and its influence on wheat yield.

The rain data of Rothamsted have been analysed for 65 years; there are indications that wet years tend to occur in spells; a continuous and progressive change is observable in the distribution of the rain through the year; in other respects the sequence appears to be fortuitous. Rainfall changes account for only a portion of the slow changes observed in yields.

Curves showing the average effect on yield, for each additional inch of rain throughout the year, have been obtained for 13 plots of Broadbalk wheat field which have been under uniform treatment since 1852. On all plots dry weather is beneficial. A detailed comparison of plots indicates the predominant influence of the effect of rain in removing soil nitrates; the cause of other well-marked features cannot safely be asserted without further research.

W. S. G.

901. **The Wheat of the Roman Campagna in 1923-24.**

TODARI, F. Osservazioni su grani della Campagna Romana, nel 1923-1924. *Nuovi Annali dell'Agricoltura del Ministero dell'Economia Nazionale*, Year IV, No. 3, pp. 403-406. Rome, 1924.

The author reports that the impulse given to wheat-growing in the Roman Campagna continues to increase and that the improved varieties of wheat put within the reach of the farmers of this district have proved an incentive to radical reforms in the technical and economic departments of the farms.

Wheat varieties that are grown with marked success in the Campagna are mentioned ; these include *Inallettabile* 96, *Turgido* 258, *Gentile* 58, *Marzuolo* 87, *Romanello* 187 and others, and from the condition of the hard types of wheat observed growing here and there in the fields, the author is convinced that it is advisable for the Roman farmer to give more space in the rapidly extending area under wheat to these hard types, which are of the highest importance to the cereal-grower of the Campagna.

A. C. M.

902. **The Best Times for Sowing Winter Wheat and Winter Rye in Norway.**

VIK, K. Satidsforsøk med høstrug og høsthvete. *Meldinger fra Norges Landbrukshoiskøle*, Parts 2 and 3, pp. 73-89. Christiania, 1924.

From 1917-1922, experiments were conducted on two varieties of winter rye and of winter wheat respectively. The sowings were made every week from August 16 or 23 to September 27, viz., for 6 or 7 weeks. Of the two varieties of each of the cereals used one was more distinctly of a winter type than the other.

The more distinctly winter variety of native rye produced the highest yield, almost without exception, when sown at the earliest date. The other variety (Petkus rye) did badly when sown so early, the best results being obtained from seeding on August 23.

After this date (both in the case of the Petkus and of the native Norwegian rye), every delay of one week reduced the straw and grain per hectare 500 kg. and 250 kg. on an average. The native rye however proved more able than Petkus rye to stand very late and very early sowing.

The winter wheat derived rather less benefit from early seeding. The Dickkopf variety in particular (the least cold resistant type), often suffered from lodging when sown early, and as the wheat had already tillered freely in the autumn, it did not seem as capable as later-sown wheat of repairing this damage by spring tillering. As a rule, the best results were obtained by sowing in August 30, but the two later seedings produced nearly as good crops.

The best results were obtained with the native variety of wheat when the seed was sown on August 23. In the case of both wheat and rye, the native variety suffered less from lodging than the foreign variety, if sowing was deferred too late.

Sowings made at a very late date (end of September) gave worse results with wheat than with rye, partly on account of the winter cold, and partly because the spring drought hindered tillering.

R. D.

903. **Some Factors affecting Water Absorption and Germination of Maize.**

DUNGAN, G. H. *Journal of American Society of Agronomy*, Vol. 16, No. 8, pp. 473-481, tables 6, bibliography. Geneva, N. Y., 1924.

The author's experiments were carried out to ascertain how the water absorption and germination of seed are influenced by the stage at which the cereal is harvested, and by the chemical and physical composition of the maize kernel.

It was found that seed harvested before complete maturity absorbed water more rapidly and had a greater absorptive capacity than that which had been allowed to mature completely on the stalk.

Maize containing a high proportion of soft starch in the endosperm imbibed water more rapidly than maize with a lower proportion of soft starch. A high proportion of horny starch reduced water absorption. Maize which was nearly disease-free was relatively high in horny material.

Rapidity of water absorption was associated with quick germination, Seedling vigour, however, more often accompanied horniness of the kernel. Mature seed germinates slower, but with more vigour than that harvested before maturity.

The investigations indicate that high protein content, with its resultant horny character of the endosperm, may be an important factor in seedling vigour. This character is co-existant with disease freedom; hence the choice of horny seed for planting is advisable.

W. S. G.

904. **Maize Yield and Rainfall.**

Journal of Department of Agriculture, Union of South Africa, Vol. VIII, No. 3, p. 268. Pretoria, 1924.

The data of rainfall and yield of maize obtained by the Glen Experiment Station, Orange Free State, show the average crops from an area of 600 acres of maize grown in the Seneka District. The figures show a definite relationship between yield and rainfall, and also indicate that a rainfall of less than 20 inches during the growing period is likely to result in a yield below 4 bags per acre, which on this particular farm is the margin of unprofitableness. The rainfall during four seasons out of nine was so low that the crop was unprofitable and indicates the risk of maize farming in that particular area.

W. S. G.

905. **" Scagliolo " a Maize Hybrid.**

ZAPPAROLI, T. W. Granturco " Scagliolo ", *L'Italia agricola*, Year LXI, No. 8, pp. 378-383. Piacenza, 1924.

The author describes "Scagliolo" as a hybrid resulting from crossing varieties with long seeds and smooth round corona (Fig. 146). Sometimes it shows intermediate qualities. " Scagliolo " is much prized and could serve as a basis for further systematic crosses, the first generation hybrids being likely to be satisfactory It grows very tall measuring from the soil-level to the insertion of the sheath of the last leaf 2.10 m. — 2.50 m. The chief ear is inserted on the 7-8 node at 1.15-1.35 m. from the ground. Each plant usually bears 1-2 ears, although sometimes a third is present. The ears are subconical and generally about 18 cm. long with normal variations ranging from 16-20 cm. The caryopsides develop differently. Each ear bears as a rule 40-45 grains; the whole cob weighs 200-250 gm. and is of a bright orange colour. " Scagliolo " produces 40-45 quintals of grain per hectare; the weight of the seed varies from 78-80 kg. per hectolitre.

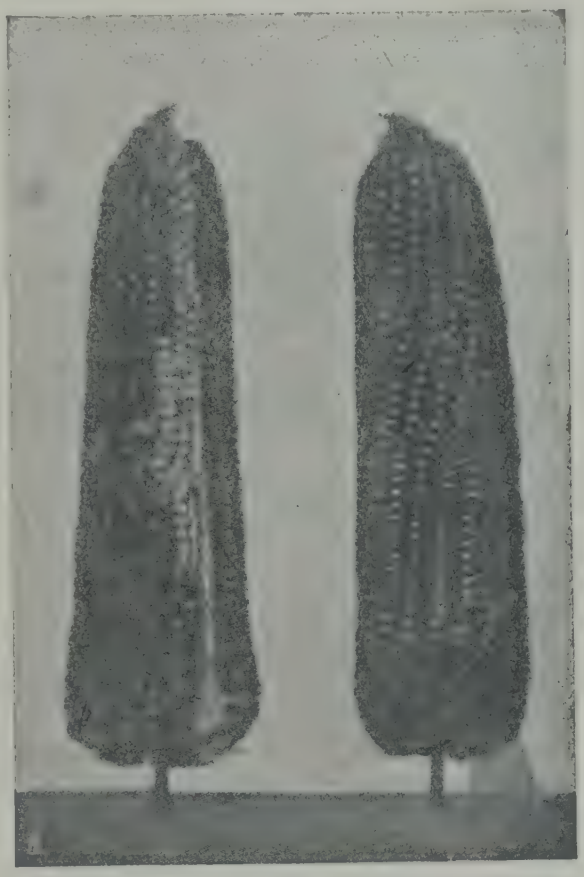


FIG. 146. — Two fine cobs of « scagliolo » transparent (*dent.*).

This maize is not specially early, but it cannot be called late. A well worked, liberally-manured soil is necessary and at least one thorough irrigation at the end of July or the beginning of August, immediately after flowering. A. C. M.

906. **" Quarentón " Maize in the State of San Paolo Brazil.**

LOBBE, H. (Director do Campo de Semento São Simão, S. Paulo), Milho " Quarentón ". *Brasil agricola*, Year X, No. 113, pp. 137-140, figs. 3. Rio de Janeiro, 1924.

Quarenton maize, which is indigenous to Argentina, owes its name to the fact that it heads 40 days after sowing. Only 90 days elapse between seeding and harvest, hence it is the earliest of the hard types of maize. The grain is small, but uniform, of a fine orange-yellow free from any starch-

like patches. The cob is of average size, but very frail (14 rows of 38 grains). Two crops can be obtained in 6 months. This maize is well adapted to association with coffee-bushes, for it does not grow very high and is unexacting as regards soil.

The author has grown this variety for seed-maize for distribution among farmers (the seed at present on the market fetches a very high price), and has proved this maize to possess excellent cultural and commercial qualities; the chemical composition is satisfactory and the flour nutritious. F. D.

907. **Maize Silage.**

WOODMAN, H. E. and AMOS, A. (School of Agriculture, Cambridge University). *Journal of Agricultural Science*, Vol. XIV, Part 3, pp. 461-468, tables 3, bibliography. London, 1924.

Maize is pre-eminently the best crop for silage, but in England attempts to produce silage from maize are often unsuccessful. It was shown by RUSSELL and ANNETT in 1908 that the average loss of dry matter caused by fermentation and drainage amounted to as much as 36 %.

It would seem that the summer climate in England does not allow either a long enough growing period, or a sufficiently hot one, to mature the crop sufficiently. A more important cause of failure is probably that the variety of maize grown (American Horse Tooth), is one of the slowest to mature.

The authors' experiments showed that maize silage of good quality can be produced with losses of dry matter comparable to those found in the production of oat and tare silage.

Excessive drainage of juice consequent on immaturity of crop, contributes materially to the total loss of dry matter.

Success will probably depend on growing a variety of maize which is able to reach the required state of maturity, under the given climatic conditions, before being cut for the silo. Preliminary trials have indicated the suitability of varieties such as Saltzer's North Dakota, Longfellow, Compton's Early and White Cap, all of which mature at least a month before American Horse Tooth.

W. S. G.

908. **Loss of Nutrients in the Silo and during Field Curing of Maize.**

RAGSDALE, A. C. and TURNER, C. W. (University of Missouri). *Agricultural Experiment Station Research Bulletin* 65, pp. 1-10, tables 2, bibliography. Columbia, Missouri, 1924.

The average losses of nutrients in 54 silos were compared with the losses of 10 shocks of maize fodder. The data indicate that the loss of dry matter and of nitrogen free extract in the field curing of maize, is shown to be approximately twice as great as that of the unavoidable losses of nutrients in the silo. M. L. Y.

909. **Maize in Brasil.**

HUNNICUTT, B. H. O Milho Serviço de Propaganda agricola, Escola agricola de Lavras, Minas, *Boletins Nos.* 1 to 5. Lavras, 1924.

The Agricultural Propaganda Service of the School of Agriculture (Minas Geraes, Brazil), has begun its publicity work by bringing out 5 Bulletins devoted to maize ; the subjects dealt with are as follows :

1) Preparation of soil for maize ; seeding and cultivation ;

2) Seeds: selection and improvement. The results of 6000 experiments have shown that the average general yield from selected native seed is higher than that obtained from imported seed. No labour is so well repaid as the careful selection in the field of the best seed-corn to be sown. The germinating precentage of the maize-seed produced at the Lavras School was never below 95. The School produces improved seed for distribution to farmers.

3) Soils and fertilisers.

4) Threshing and grinding, uses, and markets. (about 40 % of the Brazilian maize crop is used for human consumption ; 50 % is fed to swine and 10 % to other live-stock. Various recipes for preparations with a basis of maize, or maize-flour, are also given.

5) Silaging forage maize. The practice and advantages of silaging ; silo-construction ; value of silage ; Government prizes awarded to the manufacturers of silos. All these bulletins are written in a clear and concise style for the benefit of the rural population. F. D.

910. **Size of Rice Seedlings with Reference to Rate of Seeding and Yield.**

TORRES, P. J. (Alabang Rice Station). *Philippine Agricultural Review*, vol. XVII, No. 1, pp. 13-20, tables 8. Manila, 1924.

Many rice growers pay little attention to the advantages of one type of seedling over another, and the object of the author's work was to supply a guide to the proper rate of seeding and to show the difference in yield obtained from large and small seedlings.

From results of experiments it was shown that the maximum number of vigorous seedlings were obtained by sowing seed of 91 to 100 per cent. germination,at the rate of 43.5 kg. to 325 sq. m. of seedbed.

Large seedlings produced a greater number of culms to the plant, and also gave higher average yields of grain per plant, and greater yield per hectare than small seedlings.

Thick seeding tends to produce weak seedlings, hence small crops.

The total production of small seedlings was only 45 per cent of that yielded by the larger seedlings. W. S. G.

911. **The Effect of Spacing on Tillering and Production of Three Varieties of Rice.**

RODRIGO, P. A. *The Philippine Agriculturist*, Vol. XIII, No. 1, pp. 5-28, tables 12, bibliography. College of Agriculture, University of the Philippines, Los Baños 1924.

The varieties employed by the author in his experiments were : Daluson, Murmuray, Diquet and Bolilising

The growth and distribution of weeds throughout the field was practically uniform, but it was much easier to weed the plots where the hills were set further apart.

The chief conclusions arrived at as a result of the experiments were :

(1) The greater the space allowed to each plant, the greater the number of fruiting culms.

(2) Among the six distances of planting (10, 15, 20, 25, 30 and 40 centimetres apart each way) and with one plant per hill, 30 cm. each way gave the best yield for Daluson and Murmuray. For Diquet and Bolilising the distance of 25 × 25 cm. gave the highest yield

(3) When the hills are set at 25 or 30 cm. apart each way, a saving of labour in transplanting is effected of about 36 per cent. or 58 per cent., as compared with 20 × 20 cm. planting, the average distance for rice in the Philippines

It is suggested that further investigations should be carried out with other varieties of rice, to determine the best spacing distance and rate of seeding, with respect both to production and net profit W. S. G.

912. **Handling Rough Rice to Produce High Grades.**

SMITH, W. B. *Bulletin No.* 1420, pp. 22, figs. 19. United States Departement of Agriculture, Washington, D. C., 1924.

The author draws attention to the importance of the production of high grade rough rice, both to the farmer and to the State, and discusses many of the factors which cause rough rice to bring a low market price, and how such factors can be reduced or eliminated. The defects which cause milling difficulties are described and how to avoid them, and how to produce rice free from weed seeds, red rice and other cereal seeds.

W. S. G.

913. **Value of Subterranean Clover (*Trifolium subterraneum*) as a Fodder Crop.**

SPAFFORD, W. J. *Department of Agriculture of South Australia, Bulletin* No. 181, pp. 1-15, figs. 6. Adelaide, 1924.

Subterranean Clover (*Trifolium subterraneum*) although known as a roadside weed in Europe for some time, has proved in South Australia a superior fodder plant, much relished by live stock, as well as a good soil renovator and valuable in the elimination of useless weeds. The power of burying its seed below the soil surface renders this species equivalent to a perennial.

A description of the habits of the plant, indicates the dense growth and the adptability to almost all types of soil, even the "sour" soils, provided that phosphatic fertilisers are applied to the land. This is still more important in temperate climates where the rate of 2 cwt. superphosphate (26 %) per acre per year is advised. Shallow seeking is essential at the rate of 6-10 lb. per acre or 2 lb., if sown with a cereal crop. The author gives details of the method of handling the crop em-

ployed in Australia, and the facilities of harvesting. The only pest observed is the "lucerne flea" (*Smynthurus viridis*), but the damage is confined to seed crops only.

The best grasses for a mixture are the perennial rye grass (*Lolium perenne*), and the Italian rye grass (*Lolium italicum*). On drained peat lands, this is recommended, sowing at the rate of 4 lb. clover to 20 lb. rye grass.

M. L. Y.

914. ***Sesbania aegyptiaca* as a Fodder Crop.**

Department of Agriculture, Bombay, Bulletin No. 115, pp. 1-12, Poona, 1924.

The "shevri" (*Sesbania aegyptiaca*) has been used for fodder purposes in Western India for some time past, but it is considered probable that if the system of cultivation hitherto employed is modified to suit other conditions, the crop may prove of distinct value elsewhere. At present it is grown on land on either side of the large rivers below flood level, and is used to protect from flood damage and also as fodder; it is also grown as a rotation crop with sugar cane. A detailed description is given of the two methods employed and reference is also made to the utilisation as a hedge plant, as a windbreak round orchards, as a border for lucerne and similar crops, and as a support for young betel vines. In every case the plants are pruned after growing to a height of 8-10 ft. and the prunings fed to livestock.

According to the reports of experiments made in several parts of the Deccan and Surat the following conclusions have been drawn:

(1) Compared with lucerne, *S. aegyptiaca* gives much more woody fibre, but is relished by sheep and goats, and not much difficulty is found with cattle. It is valuable as a rich leguminous fodder, and is both easier and cheaper to produce than lucerne; requires less manuring and is less easily injured by weeds.

(2) It will stand a certain amount of flooding and water logging without injury.

(3) It is very resistant to the presence of salt in the soil.

(4) It will stand hot dry winds without injury.

(5) It improves the land on which it grows.

As regards yield, it is estimated that with abundant water and suitable soil it should give from 25 000 to 30 000 lb. of green fodder per acre in each of the first three years, but will not be profitable for more than four years.

M. L. Y.

915. **Korean Lespedeza as a New Forage Crop** (1).

PIETERS, A. J. and VAN ESELTINE, G. P. *United States Department of Agri- culture, Circular* 317, pp. 1-4, figs, 12. Washington, D. C. 1924.

Reference has recently been made to the economic importance of the Korean lespedeza (*Lespedeza stipulacea*), and the present pamphlet gives a detailed description of the habits of growth and seed production.

(1) See *R.* 1924, No. 625 (*Ed.*)

The crop matures early and is coarser than the Japanese species (*L. striatal*. Although it is not a hay crop, and is not recommended for districts where the clovers will thrive, the value lies in the fact that the plant is drought resistant, and will grow on relatively poor acid soils. As regards resistance to disease, susceptibility to *Sclerotium rolfsii* has been observed in the Southern States, but this is not common in the North.

M. L. Y.

916. **Losses in Wilting and Ensiling Sunfowers** (1).

NEWTON, R. and BROWN, W. R. *Scientific Agriculture*, Vol. IV, No. 12, pp. 385-393, Tables 6, bibliography. Ottawa, 1924.

As a result of the drainage losses incurred with sunflower silage, experiments have been made to test the advantages of wilting the plants before placing in the silo. The authors have made further tests which, however, demonstrate the difficulties attached to this process. Analyses were made of the juices flowing from a silo filled with freshly cut sunflowers, and the changes caused by wilting. It appears that the loss of dry matter during three days' wilting is equal to that incurred by a drainage loss of 25 % of the green weight of sunflowers ensiled in the fresh condition.

During wilting, the catabolic activity (respiration, etc.) was accelerated, but the crude protein suffered the greatest loss. In most cases wilting improved the quality of the resulting silage to a limited extent, provided that the period of wilting was not excessive. After 9 days wilting, the quality and palatability was decreased owing to the increase in amino-nitrogen and water soluble nitrogen indicative of protein splitting. An analysis of the fermentation and quality of silage from fresh and wiltered sunflowers showed the loss of readily fermentable carbohydrates after wilting, and a further disadvantage is the marked increase of crude fibre.

The various analyses indicate that freshly ensiled sunflowers, or only slightly wilted are preferable. But as in both cases about 40 % of the dry matter is lost, a further method adopted at the Experimental Station, Beaverlodge, Alberta, has proved more promising, namely to ensile sunflowers in the fresh condition, but mixing them in the cutting box with some dry material such as oat sheaves or straw. An example of this method is described with an analysis of the resulting silage, which proves the fermentation to be of a highly desirable type, with a minimum wastage. It is strongly recommended therefore to ensile sunflowers along these lines where the height of the silo permits sufficient pressure to ensure proper packing and curing.

M. L. Y.

(1) See *R.* 1923, No. 379. (*Ed.*)

Industrial Crops.

917. Manioc Cultivation in the State of San Paolo, Brazil.

MACHADO, G. A cultura da mandioca no Estado de São Paulo. *Revista da Sociedade rural brasileira*, Year V, Nos. 49-50, pp. 233-239. São Paulo, 1924.

Manioc grows well throughout the whole State of San Paolo and can be cultivated with equal success on the red soils and on clayey-sands, or sandy-clays ; it is grown on a large scale in Araras and Pindamonhangaba.

Manioc is generally regarded as a crop requiring a soil rich in potash, but in San Paolo, it thrives at Orlandina, S. Joaquim, Ituverava and Igarapara, producing plants with roots weighing 21 to 33 kg., although the soil contains only traces of potash.

The varieties of manioc most cultivated in San Paolo are " Cambaia " and " Vassourinha ". The first contains 20 to 25 % of starch while 18 to 22 % of starch is obtained from the second and 28 to 33 % of flour.

The crop is cultivated in a very rudimentary manner. As a rule, pieces of the root are planted and the field is weeded two or three times during the vegetative period, which lasts 18 months. The ground is not always ploughed.

The practice of removing the leaves towards the end of the vegetative period is a great mistake, for instead of increasing the size of the roots, it only causes them to elongate and reduces their starch content.

The average unit root production per hectare varies from 18 tons on the clay soils of the northern part of the State, to 60 tons on the recent clayey-sands of the North-West railway zone. The average general starch content is 20 %.

The cost of cultivating one " alqueire " (2.42 hectares) has been estimated at the Araras farm, 87 km. from San Paolo, as follows : clearing the ground 110 *milreis* — ploughing 40 — harrowing 10 — planting 40 — hoeing 270 — harvesting 80. The value of the crop when the roots are suitable for flour-making, which is the usual manner of employing them, is given in the appended table. The figures refer to three municipalities. A by-product of the flour manufacture is starch ; this is recovered by allowing the juice to settle that has collected in the presses and afterwards decanting it. For every 50 sacks (of 45 kg) of flour made, 3 sacks (of 50 kg.) of starch can be obtained in addition. The flour is made by grating the roots by means of a hand apparatus or by a hydraulic engine, the product being subsequently pressed, dried in a store and ground. There is only one factory for flour intended for bread-making ; this is at Casa Branca, Fazenda S. Anna.

There are also starch factories, but these are generally connected with textile factories which consume the entire output. Starch costs 0.25-0.35 *milreis* per kg. to make, and sells in the country at 0.5 *milreis*. The largest factory where starch alone is made is attached to the Matarazzo establishment, " fazenda " Corupatura, at Pindemonhangaba, where the output is 110 sacks per day. The harvest and the preparation season last from March to October. When their own crop is insufficient to keep

the mills going, the factories buy manioc at the rate of 35-45 *reis* per kg. delivered at the factory.

Cost of producing and preparing manioc in three municipalities of the State of San Paolo.

(Milreis per alqueira; one alqueira = 2.42 hectares).

	Pindamonhangaba	Guatapará	Araras
Cultivation	347	350	470
Harvesting	120	140	80
Grating	150	—	—
Carriage to factory	210	40	150
Preparation of flour	562	360	350
Sacks	555	480	560
Transport to station	24	150	35
Transport to market	(1) 375	(2) 240	(3) 165
Total	2 343	1 760	1 810
Value of product	(4) 4 164	(4) 3 600	(5) 3 600

(1) At Rio de Janeiro, 323 kg. distant, — (2) At San Paolo 489 kg. disant. — (3) At San Paolo, 87 kg. distant. — (4) At 12 *milreis* per sack of 45 kg. — (5) At 10 *milreis* per sack.

In the case of Manioc, as in that of other crops, the possibility of extended cultivation depends upon the roads and means of transport. Thus, in the north-west railway zone where very large crops of manioc can be raised, production has to be limited to the amount that can be disposed of in the small neighbouring markets, on account of the cost of railway freight and transport from Sorocabana to San Paolo, or Santos.

Great damage is done to manioc crops by rodents (rats, armidilloes, etc.), but the only serious disease to which manioc is liable is root-rot which occurs in very moist soils. In 1915, the Sphingid Lepidopteron, *Dilophonata Ello* which is the most formidable pest attacking manioc in other countries, appeared also in Brazil, but owing to the strict control measures adopted, it did little harm and has never reappeared. F. D.

918. The Hawaiian Tree Fern as a Source of Starch.

RIPPERTON, T. C. *Bulletin No. 53, United States Department of Agriculture* pp. 16, plates, 7. Washington, D. C., 1924.

The Hawaiian Islands contain many thousands of acres of tree fern forests from which starch can be extracted. Three species are found, only one of which, Hapu (*Cibotium chamissoi*), is used for starch production.

The crowns, lateral shoots and undeveloped buds on the trunk may

all be used for propagation, but the growth is slow, twenty years being required to reach sufficient size for starch production, hence it is not practicable to plant cuttings.

The care of the tree fern is similar in chemical composition to that of other starch plants, especially of edible canna.

The starch is used both as a food and for laundry purposes. For laundry work the starch is much superior to maize starch.

The high costs involved in securing the raw material prevent the starch becoming a competitor with the common commercial starches, but, with the cheap labour available in many tropical countries the cost of production would be much less than is the case in Hawaii. W. S. G.

919. **Scientific Cotton Growing and Transport.**

Authorities:

I. JACKSON, R. H. "*Cotton*", No. 1487, p. 13, Manchester, 1924.

II. LEPLAE, E. Rendement de la plantation du coton, *Bulletin Agricole du Congo Belge*, Vol. XIV, No. 4, p. 701, Brussels, 1923.

III. *Les Cahiers Coloniaux*. Circular of the Lieutenant Governor of the French Soudan. *Report No.* 220, p. 483. Marseilles, 1924.

IV. WADDINGTON, M. Report on journey in French Soudan, *Bulletin de l'Union Coloniale française*, May, p. 53. Paris, 1924.

V. "*The Times*" *Trade and Engineering Supplement*, p. 461, July 26, 1924. London.

VI. Cotton Transport Act. *Annual Report of the Indian Central Cotton Committee* for year ending 30 August, 1923, p. 10. Bombay.

Mr. R. H. JACKSON, Chairman of the Executive Committee of the Empire Cotton Growing Corporation, in a recent address, referred to the increase of cotton production in new areas within the British Empire, which had risen from 72 600 bales in 1917 to 178 000 bales in 1923. He expects further increase in 1924, and "sees no reason why the progress should not be accelerated if we can only get the transport required to move the crops promptly".

Mr. Jackson fully realises (a) that new cotton fields must be the outcome of scientific supervision, seeing that such supervision has been the main factor determining the progress made during these six years;

(b) that scientific cotton growing is capable of considerable extension and development;

(c) that the general question of transport is very pressing and likely to become even more acute as further extensions take place.

He concludes by indicating that the time occupied in transit is of the essence of the problem.

The following notes deal with the four points raised in Mr. Jackson's address, points which are no less applicable to the cotton production of other nations than to the cotton fields of the British Empire.

In the first place, it has become apparent to those who are engaged in developing cotton growing in new areas that the work is really of a scientific character, calling for thorough preparation at every stage, be-

ginning with the selection of seed, continuing throughout the period of development, and concluding with the gimery, the cotton press, and the despatch to market or factory. The fact that the American negro, who has no pretensions to scientific knowledge, is the grower of more than half the world's annual yield of cotton, does not in the least disprove the highly technical nature of cotton growing outside America. The negro has a long tradition of cotton growing; he has learnt from his earliest years the peculiarities of the American cotton crop, and he is unlikely to omit any necessary detail of his work, though it is, in the nature of things, impossible for him to improve on his present somewhat rough and wasteful methods. The *Agence Economique de l'Afrique Occidentale française* states that the German Government of Togo attempted to raise cotton under American negro management but quickly abandoned the scheme, as the negro was useless, outside his own Southern States.

The Indian cotton-grower again, has seldom really proved successful in improving the quality of his crop, despite official encouragement; attempts to establish a satisfactory staple are only now bearing fruit, and chiefly in the Punjab settlements, where organised scientific supervision is practised.

M. E. Laplae, writer of an article on Cotton Production in the Belgian Congo, may be quoted in support of the main argument. After declaring that cotton in the Congo, as is generally the case with tropical countries, is a crop adapted only for native labour, proceeds to show how the European planter may find a remunerative occupation in cotton growing if the following conditions are observed. He should begin by selecting and clearing his ground, perhaps 1250 acres (500 hectares) in some part of the vast region of the Congo, keeping to the districts where it has already been found that cotton will flourish. In the first season he should clear only half the area, and for this purpose the work of about 300 natives will be required in the course of six months: the conclusion of the period should coincide with the proper moment for planting selected seed, which is easily obtainable in the Belgian Congo. After the planting, all the weaker plants appearing where a sowing of five or six seeds has been made should be thinned out. At the same time the first cultivation or cleaning is carried out, to be succeeded at the proper time by two further cleanings, as the plant grows, and approaches the flowering stage, three or four months after sowing. At the end of this period the bolls begin to open, and picking commences. This must be carried out systematically, each row of cotton bushes being visited every ten days, until the yield of all the successively maturing bolls has been gathered.

It has been mentioned that the clearing of ground requires 300 natives who are fairly expert at this particular branch and would require only such supervision as is necessary to keep them at work. But for sowing, thinning, cleaning and picking, the native is not sufficiently skilled and requires constant instruction and supervision. One Belgian writer remarks that the ordinary native of the Colony is about as amenable to control as the wild antelopes of the country. To ensure any sort of success, therefore, the intense and continuous supervision by the European

is essential at the special times indicated. Between the various operations, there are periods of quiescence : but the planter will do well to pay constant attention to his cotton fields. He has to be on his guard against insect enemies, wild animals and perhaps locusts, which require prompt control measures, and that without intelligent help from native sources. Similar vigilance is also necessary at the ginnery, and in pressing bales.

M. Leplae considers that the place for the ginnery is the centre of the 500 hectare plantation, so that the transport of the seed cotton can be carried out cheaply. Such a convenient arrangement may not always be practicable, but it is clearly one of the points that should be included in an ideal scheme of scientific cotton growing. M. Leplae's scheme provides for two machines of 50 saws each, with an output of 10 to 12 bales of lint per day, thus in two months dealing with the entire crop of which the yield expected is 200 kilogrammes of lint per hectare from 500 hectares. M. Leplae, as already stated, would clear of forest, etc., only 250 hectares in the first year, and the other 250 hectares in the second year, and would then continue cropping the same land, keeping 250 hectares under cotton each year, and making rotations on each plot with various other crops, such as will provide green manure for the cotton fields, where cotton seed can also be used as a fertiliser. Maize may also form a useful catch crop.

The article concludes with a warning, or reminder. In the writer's view there is distinct danger in the fact that cotton seems to grow so easily. Hence it is often assumed that special knowledge is unnecessary and that consequently the supervision may be safely entrusted to any trader or farmer. That this is a misconception soom becomes evident, for an annual crop, such as cotton, if not well cared for, gives no result at all, and the capital outlay is quickly dissipated. The energetic and capable scientist, with experience of cotton growing in a tropical country, is an indispensable agent, if success is to be obtained, at any rate so far as the Belgian Congo is concerned.

The account of the cotton crop in the Belgian Congo, as given by M. Leplae is partly hypothetical in so far as it relates to any extensively organized scientific production in that country. There is, however, an ever increasing yield of cotton in the Congo, and the conditions of climate and soil are doubtless quite accurately estimated. It only remains to establish the organization necessary for proper control on a large scale during the period of growth, and to organise transport to the seaboard, which can bring the cotton to market with the minimum of delay. It is stated that two months are probably required for ginning, including pressing and bailing. Ideally the cotton should reach it destination in another two months. There is good reason to suppose that the actual transit occupies something like six months, from the plantation to the Belgian spinning mills which deal with the whole production of the Colony. Some of the cotton grown in the eastern area finds its way across Tanganyika Lake and Territory, to be shipped at Dar-es-Salaam, a very long process, but doubtless of shorter duration than a transit entirely through the Congo Colony to its own port on the Atlantic.

Mr. Jackson's views on the acceleration of progress in new cotton areas will be very generally accepted. It may be that the present number of cotton-growing experts is limited, but practical experience in the cotton field is soon gained by the trained student, and facilities for such students have been organised by the Empire Cotton Growing Corporation, and hence a considerable increase in the number of thoroughly expert growers may be reasonably expected before long

The very remunerative prices obtained in the cotton markets lately have naturally encouraged the desire to grow cotton in many lands; it is improbable that all these efforts will be successful, but progress in the aggregate will doubtless result.

But every new extension of cotton growing is of necessity subordinated to the question of transport. It is not very many years since the sole means of carrying cotton to market in West Africa was on the heads of porters, as is indeed still the case in some parts of the interior, though there are now railways in existence that shorten the journey, and provide less wasteful methods of transit from the up-country centres to the coast. It can scarcely be expected that exhortations to grow more cotton in Dahomey or the French Sudan, emanating from the Administration, will have their full effect until the railway is brought within a reasonable distance: there are numerous villages where cotton has long been grown for local domestic requirements, and merely a small percentage, if any, of the production has been marketed elsewhere. The new line from the Upper Niger to the Upper Senegal River has been welcomed by the colonists who regard it as a real aid to their efforts to introduce exotic species of cotton into the French Sudan for cultivation under irrigation methods. The railway not only revolutionises the methods of transit for the cotton lint, but facilitates the transport of the engineering plant and agricultural implements to the cotton fields.

It may also gradually prove to be advantageous to market the cotton seed which up to the present has been used solely as a fertiliser and to establish seed-crushing machinery so as to send the oil to France as well as the cotton.

Economies in these and other directions will do much to promote the establishment of cotton growing in West Africa on a sound basis; such economies are almost certain to become of vital importance, when the price of cotton again approximates to its former moderate level. So long as the European price exceeds one shilling per lb. the cost of transport is not everywhere a particularly important factor, since one penny per pound is equivalent to 9.33 pounds sterling per ton, an amount which will pay for a good deal of rail and steam transit. The case would, however be very different if cotton were to decline to seven pence per lb. the price obtained in 1921, which excluded from the markets most of the cotton grown where there was no railway line in the immediate neighbourhood of the plantation.

Reference has been made to the means of communication in parts of West Africa and in the Congo, but in other African cotton fields the development of transport has been more marked, though as a rule it is

less rapid rate than the expansion of cultivation. Last year the crop in the Kassala province of the Anglo-Egyptian Sudan was still carried to the coast on camel-back, to-day all the transport is by rail, and a scheme is under consideration for the further extension of the line, through rain-fed regions, where cotton growing has already begun to be important.

The railway system in Nigeria, which is already linking up places hundreds of miles apart, is in process of further development through a country well suited for cotton, while thousands of bales are already grown under scientific supervision wherever transport is available.

Nyasaland and Rhodesia are in process of obtaining similar access to the sea through the port of Beira, though their great river, the Zambesi, has proved to be a hindrance rather than an aid to development.

Uganda however affords the most notable example of the benefits of a transport service. The Uganda railway from the coast at Mombasa lies wholly within the Colony of Kenya and, though it reaches the shores of Lake Victoria Nyanza, the existing railway wharf is still some way from the boundary of the Uganda Protectorate. Under the guidance of scientific experts, however, and with a sagacity and perseverance not to be found among neighbouring peoples, the Buganda set to work some fifteen years ago to grow cotton, and their country now yields 100 000 bales from a little under half a million acres. Without the railway even a beginning could hardly have been made ; today the Uganda cotton crop is worth nearly three millions sterling, and the railway is now on the way to prosperity.

Further developments bringing railway facilities into Uganda proper are being planned and will give access to a larger area of cotton land in the Protectorate as well as in the neighbouring Colony of Kenya.

The need for increased cotton production is fully admitted ; this need can only be met by increasing transport facilities from regions suitable for production ; whether in Africa, Brazil, Argentina, or Australia, the problem is the same, though naturally to some extent affected by local conditions.

Lastly Mr. Jackson lays special stress on the necessity for having the " transport required to move the cotton crops promptly ".

It should be noted that the Uganda railway is a single line and has only within the last year or so provided a fair number of passing points or sidings. Like other enterprises of similar character it suffered in efficiency from its immediate success, and the traffic rapidly became too heavy for its resources. The Uganda cotton has to be put on board Lake steamers or other craft after being brought down from the ginnery, there are delays at nearly every stage, and the most serious at the railway wharf. Hence it is not surprising that the transit of the crop to the seaboard covers many months of the year. These conditions involve much uncertainly and actual loss for all concerned. The ultimate buyer, whether in Liverpool or in Japan, requires to know when he may expect delivery of his order and can afford as a rule, to give a better price if he is satisfied on this point. Cotton if delivered to the spinner in August may be worth much more than if it reaches the mill in November. In the current

season the cash difference in favour of delivery in the earlier month has been about three pence per lb., or six pounds (£6) per bale, including interest on the value, reckoned at fifteen pence per pound in Uganda.

The time problem has already been mentioned in connection with the long transit to the seaboard through the Belgian Congo, where the transfer from rail to river and vice versa is a fertile source of delay; it may also be noted as of much importance in Brazil, where railways do not yet reach some of the best cotton land, nor even all of the old established plantations. The time problem is also important in respect of possible new extensions in Nigeria, Rhodesia, Nyasaland and particularly in South Africa, where several promising cotton areas are at a considerable distance from the existing railways. It has also to be taken into account in connection with the development of cotton growing in Argentina and Paraguay, which are mainly dependent on their river navigation for transport from the tropical cotton fields to the distant seaboard. At times the upper reaches of the Parana are too shallow for any but light craft traffic and there are often long delays.

Facilities for the transport of cotton may be misused, and in consequence a partial control of certain internal movements of cotton in India was established by the Legislature in 1922-23. One of the main objects of the Indian Central Cotton Committee has been the giving effect to this legislation. A whole series of abuses which have done much to spoil the good name and lower the value of Indian cotton can now be checked. In the past, short staple cotton, waste and stained cotton have been transported by rail to areas growing longer staple, for mixing purposes. Fully pressed bales have been sent to stations with a good reputation, for subsequent despatch under a false description to Bombay. Indian cotton is largely marketed by territorial description and it is therefore necessary to protect areas growing the better qualities. The profits made by unscrupulous middlemen are much less than the economic loss sustained by the grower and the spinner.

The areas protected in 1923 by notification under the Act of the Legislature are Southern Gujerat, the Southern Division of the Bombay Presidency, the Central Provinces, Berar and the " Cambodia " cotton district of Madras. Contiguous Indian States have adopted the procedure and are acting in concert with the Cotton Committe. Rail transport of cotton into the protected areas is prohibited.

Some aspects of the problems of scientific cotton growing and cotton transport which are so intimately connected have been sketched above. In conclusion it may be added that in localities where owing to material or financial causes efficient transport cannot be provided, it is clearly useless to initiate or to develop scientific cotton production. In areas where good cotton cannot be produced, one of the inducements for the improvement of transport is absent. There are other agricultural crops that cannot be developed for want of transport facilities, but very few of them with the exception of cotton, can realise a price which is sufficient to guarantee success alike to the grower and the transport agent.

It also follows that new cotton fields should produce only the best

quality obtainable ; the transit charges are the same for the lower grades, and good quality cotton can always command a larger circle of buyers, in healthy conditions of competition. J. H. H.

920. **Cotton Experiments.**

O'KELLY, J. F. and COWART, R., Bulletin No. 219. pp. 11, tables 10. *Mississippi Agricultural Experiment Station*. Mississippi, City. U. S. A., 1924.

The article gives an account of experiments carried out with the object of supplying information of immediate value to the cotton grower.

The data obtained from six types of cotton grown at the Central Station are as under:

Pounds of Lint Cotton per Acre.

Years 1919 to 1923	Cook	Cleveland	Trice	Miller	Delfos	Express
Five Year Average	381.9	374.6	364.6	334.7	350.9	309.0
Average Value (Dollars)	107.85	110.14	126.07	107.44	131.63	113.70
Average length (inches)	7/8	15/16	11/16	11/16	13/16	13/16
Average Lint Percentage	37.7	34.8	30.6	33.3	31.5	31.3

Further tests were carried out on standard and new varieties, on clay loam and sandy soils.

A comparative experiment with four nitrogenous fertilisers gave the following results :

Fertiliser	Increased yield in seed cotton (lb. per acre)			Increase of value (in $) less cost of fertiliser			
	1921	1922	1924	1921	1922	1923	Average
Ammonium Sulphate.	154.7	91.2	208.8	5.51	20.14	20.11	15.25
Sodium Nitrate	187.0	88.0	270.3	6.78	18.56	26.48	17.27
Calcium Cynamide.	173.5	63.6	228.0	6.82	13.07	22.89	14.26
Cottonseed Meal.	4.7	46.2	118.4	3.25	6.53	7.64	3.66

W. S. G.

921. **Cotton in North Brazil** (1).

PEARSE, A. S. (General Secretary, International Federation of Master Cotton Spinners and Manufactures Association). pp. 122 + XXXVIII. Manchester ; Taylor Garnett Evans & Co. 1924. (Preface by Miguel Calmon, Minister of Agriculture, Commerce and Industry).

The report of the journey through the States of Ceará, Maranhão and Para, together with a synopsis of the whole of Brazil's cotton potential-

(1) See *R.* 1921, No. 1220, *R.* 1922, *page* 930 and No. 828, and *R.* 1923 *page* 1124. (*Ed.*)

ities gives a comprehensive account of the cotton growing and marketing conditions throughout the State. The report is impartial and is written primarily to give information to the members of the International Cotton Federation and to stimulate the general interest in Brazilian cotton both in Europe and elsewhere. Information was obtained through inspection of fields and ginning factories in each district, and personal contact with growers, ginners and merchants. Developments are proposed in connection with seed selection and production of pure seed and the marketing of produce (establishment of exchanges and employment of qualified graders). There is ample evidence of the suitability of climate and soil conditions in the high yields already obtained under the most elementary conditions of cultivation.

The opening chapter gives a graphical survey of the world's cotton production and consumption, and future possibilities, with a discussion on the existing advantages in Brazil. The following chapters deal with the separate States from the standpoint of topography, climate, communication systems, natural resources, economic possibilities, and special observations on cotton (varieties, seed-farm organisation, ginning, baling, export, spinning and weaving mills). A chapter is reserved for a description of the Brazilian public works against drought, and deals with the enormous reservoir consructions either projected or already completed. The work, closes with a general discussion as to the potentialities of the various cotton zones in Brazil. **M. L. Y.**

922. Fibre Production: Sisal Hemp.

GOULDING Dr. E. (Superintendent of Investigations, Imperial Institute, London). *Tropical Agriculture*, Vol. 1, No. 9, pp. 140-142. Trinidad, 1924.

The author gives a brief historical account of Sisal hemp (*Agave sisalana*), and the annual production of the fibre in Mexico. An account is then given of the efforts which have been made to establish sisal hemp cultivation within the British Empire, together with an indication of the present position and prospects of the industry in each of the following countries: Tanganyka, Kenya Colony, Uganda, Nyasaland, Zanzibar, Mauritius. **W. S. G.**

923. Two Useful Castor Oil Varieties in Sicily.

BRUNO, F. Su due varietà di ricino coltivate nel R. Giardino Coloniale di Palermo. *L'Agricoltura Coloniale*, Vol. XVIII, N° 7, pp. 229-243. Bibliography. Florence, 1924.

In view of the increasing demand for castor oil from the medicinal and industrial standpoint, experiments have been made at the R. Giardino Coloniale, Palermo (Sicily), to test the economic value of the two varieties, *Ricinus communis* var. *microcarpus* and *R. communis* var. *Baikalensis*. Details of cultivation are given, and of the analysis of the plant. It appears that the first named variety is superior to var. *Bai-*

lundensis as regards :— higher oil content 60.50 to 54.29 % (ether extraction) ; more compact growth, 1.05 m. to 4.50 m.

In Southern Italy, where the castor oil plant is a perennial, it is recommended to extend the cultivation of this variety, as it is of undoubted value. This applies also to the Italian colonies, in Eritrea and Somaliland. Reference is made to the value of the stems for fuel, and of the steamed leaves for forage purposes. M. L. Y.

924. **" Batiputa " (*Gomphia parviflora*), an Oleiferous Plant of Brazil.**

DOMINGUES, A. O Batiputá. *Brasil agricola*, Year X, No. 112, pp. 114-115. Rio Janeiro, 1924.

Gomphia parviflora is a shrub reaching the height of 2.50 m.-3.50 m. which grows wild on the sandy soils (" taboleiros ") of the States of Parahyba, Pernambuco, and Rio Grande do Norte in association with the " mangabeira " (*Hancornia speciosa*), " cajueiro bravo " (*Curatella americana*), etc.

The author has proved by his own experiments that the plant can be raised from seed if the latter is sown on suitable sandy soil, but the seeds require more than 30 days to germinate.

The oil extracted from the fruits is edible and is also used for medicinal purposes by the people. The author only succeeded in extracting 2 % of this oil, but as much as 20 % is said to be obtained. The oil has only been extracted from the pericarp so far, no attempts having been made to express it from the kernels. The fruits are washed, boiled in water and ground to a paste in a mortar.

The paste is then washed and diluted with water after which it is warmed in a caldron exposed to direct heat. The melted oil rises to the surface and is skimmed off, being already clear and ready for use.

The following data were obtained from analyses of the oil made at the " Serviço de Inspecção e Fomento agricolas " : density 0.910 — refractive index at 16°C. 1.4615 — KÖTTSTORFER index 197.12 — Iodine index 70.02 — CRISMEN index 90.31 — Acidity 12.4.

By cultivating " batiputá " at would be possible to turn to good account 900 thousand hectares of sandy land in the State of Parahyba.

F. D.

925. ***Salvia Sclarea* as an Oleaginous Crop.**

CAVARA, F. La *Salvia Sclarea*, L. quale pianta oleifera. *Bollettino della Associazione Italiana pro piante medicinali, aromatiche ed altre utili e della Società Orticola di Lombardia*, Year VII, No. 7, pp. 117-119, figs. I. Milan, 1924.

The value of *Salvia Sclarea* L. as an aromatic plant has been recognised for some time past, but insufficient attention has been given to the oil content.

Specimens were sent by the author for examination at the " Laboratorio di Chimica Farmaceutica e Tossicologica " at the University of Naples, and the results indicate the economic possibilities of the exploitation of this plant for oil purposes. The characteristics may be sum-

marised as follows : — average size 2 mm. ; moisture 8.75 % ; oil extracted with a mixture of petrol and ethyl ethers, light yellow tint with an agreeable taste and scent : specific gravity at 15°C. 0.93 ; refractive index at 15°C. 1.481 ; solidifying point of fatty acids, 8°-10°C. ; melting point 13°-15°C. ; saponification value 192.82 ; iodine value 141.2 ; it is essentially a drying oil.

Although no yield can be expected the first year, by removing the stems directly after seed production and irrigating at the same time, an abundant inflorescence may be expected the following season. On light deep soils, irrigation may not be necessary during the spring and summer.

M. L. Y.

926. **The Tanning Value of Indian Myrobalans.**

I. PILGRIM, J. A. Report on the Tan Values of Indian Myrobalans and Burma *Terminalias*. *Forest Bulletin*, No. 56, pp. 1-2, tables 2. Delhi, 1924.

II. The Characters of Indian Myrobalans. *Bulletin of the Imperial Institute*, Vol. XXII, No. 2, pp. 123-134 + tables. London, 1924.

I. — These investigations are divided into two sections, the first deals with *Terminalia* fruits chiefly myrobalans and the fruit of *T. Chebula* and the second with the products of various *Terminalia* species, excluding the fruits, and all obtained in Northern Burma. Full analysis-summaries are given with figures of calculated yield of extract of tannin and the samples in Section 1 classified according to the highest proportion of flesh to stones ; tannin content ; yield of extract ; greatest suitability for use in extract manufacture, *i. e.* the highest proportion of tannin to soluble non-tannin. In section 2 the analysis includes leaves, twig bark, bole bark, cortex of bole-bark, and wood.

II. — Report of the examination of different Indian varieties of Myrobalan, chiefly *T. Chebula*, to determine the relative values, and whether this is due to variety or to locality or other climatic causes. A variation from 20 to 49 % tannin was found in fruits containing 10 % moisture which indicates the importance of these determinations. It is proposed to extend these investigations to samples from various localities with a view to establishing the average quality and commercial value.

M. L. Y.

927. **Tannin Investigation of some Burmese Dipterocarps.**

PILGRIM, J. A. *Indian Forest Records*, Vol. X, part IX, pp. 167-189. Delhi, 1924.

The author deals with six species of *Dipterocarpus*, viz., *Hopea odorata* (thingan), *Pentacme suavis* (ingyin), *Shorea obtusa* (thitya), *D. turbinatus* (Kanyin-ni), *D. tuberculatus* (in), and *D. alatus* (Kangin-byu). A summary table of results is given showing the tannin percentage obtained from the leaves, bole-bark, cortex of branches and average bole-wood.

D. turbinatus, *D. tuberculatus* and *D. alatus* did not yield satisfactory results.

W. S. G.

928. **Indian Gums and Resins.**

DUTT, N. B. *Industrial India*, Vol. III, No. 12, pp. 547-548. London, 1924.

The author draws attention to the gums and resins of India, a class of vegetable products hitherto neglected, but which, by the adoption of proper methods might have a much larger output.

Gums are distinguished as soluble, partially soluble and insoluble in water ; all three classes are found in India.

The chief gums are described with their local and Latin names, districts where found and uses. Amongst those mentioned are *Acacia arabica, A. Catechu, A. Senegal, Anogeissus latifolia, Pterocarpus Marsupium* and *Butea frondosa.* The " hog " gums include *Cochleospermum gossypium,* the best Indian substitute for gum tragacanth. The odoriferous gums are represented by *Boswellia serrata, Commiphora mukul* and *Shorea robusta.* The resins include *Vateria indica, Hopea odorata, Canarium strictum* and the pine-resins from *Pinus excelsa, P. longifolia* and *P. Khasya.*

Allusion is made to the adulteration of gums and resins which is now practised.

The author points out the necessity for the scientific study of these products. W. S. G.

929. **The Uba Cane and its Yield of Sugar in Porto Rico.**

DOMINGUEZ F. L. *The International Sugar Journal*, Vol. XXVI, No. 307 pp. 379-380. London, 1924.

In *Bulletin No.* 28, (printed in Spanish) of the Insular Experiment Station, Rio Piedras, Porto-Rico, the author gives a full account of the Uba cane in that island, especially as regards its juice and milling qualities. The average of juice analyses from several hundred returns is as follows : — Brix 17.68, sucrose 15.51, purity 87.72 ; the plant cane is inferior in these respects to the ratoons.

The author is of the opinion that the Uba cane cannot take the place of the standard canes of Porto Rico, owing to the lower sucrose content of its juice ; but the variety may be grown on the poorest soils, and has important immunity qualities, hence could be used to increase the total output of sugar from the island. W. S. G.

930. **Coffee in Brazil and Abroad.**

RAMOS A. (Escola Polytechnica de São Paulo) *O Café no Brasil e no Estrangeiro*, 16mo p. VII + 645, tables 42, bibliography. Rio de Janeiro, Pap. Santa Helena, 1923.

In addition to much general information respecting coffee, this work incorporates the results of the authors' studies and practical experience during 50 years' management of coffee plantations in various parts of the world together with a number of facts obtained from the different works mentioned in the bibliography.

Coffee is here treated of from the historical, botanical, cultural, industrial, commercial, hygienic, and legislative points of view. The analysis of the most important questions is followed by a summary of the present state of affairs and a forecast of the future of coffee-cultivation.

The following list of the headings of the chief chapters of the work give some idea of the ground covered :

I. Geographical distribution of coffee. Historical observations.

II. *The coffee bush, climate and soil.* Botanical description of coffee. Chemical composition and weight of the green parts of the plant and of the fruit. Adverse conditions and enemies, insecticides and fungicides.

III *Brazilian coffee.* Historical information — Distribution of coffee growing — Production in the State of San Paolo — Study of the soil intended for coffee plantations — Preparation of the soil. Planting — Cultural operations — Yield and unit production — Distribution of coffee plantations in the State of San Paolo — Treatment and preparation of coffee (moist method) — Drying and desiccators — Dry method — Preparation of parchment coffee and the machinery used. Cost of production in San Paolo — Organisation of coffee cultivation in San Paulo — « Patronato agricola » and labour contracts — Coffee cultivation in the States of Minas, Rio de Janeiro, Spirito Santo, Bahia, Parana, Pernambuco. Supplementary information respecting the Brazilian States in which coffee is cultivated.

IV. *Coffee production outside Brazil.* Centres of production (Mexico, Guatemala, Salvador, Nicaragua, Columbia, Venezuela, and Porto Rico). Coffee-growing in the Dutch Indies.

V. *The world's consumption of coffee.*

VI. Supplement. Manuring coffee in San Paolo (Dr. Botelho and D. Granato). Coffee in food hygiene (Dr. Granato).

VII. *Coffee trade.* Its importance and the development of new methods. Influence of middlemen in development (Dr. De Miranda Jordão). — The coffee-trade in Santos (A. Veiga) operations on the market of Rio Janeiro. — Manipulation of coffee in New York, New Orleans, San Francisco and on the European markets — Coffee-Exchange and trade methods.

VIII. *State Intervention in the coffee trade.*

IX. *" Fazendas" for coffee cultivation* (Dr. G. Maistrello) — Effect of frosts, winds, and drought on the life and productivity of coffee ; measures to be adopted to prevent, or lessen injury from any of the above causes (Dr. F. Ferreira Ramos).

X. Summary. Forecast. Conclusions. Valuation of Coffee. Statistics.

XI. Coffee trade and consumption in 1922 (in collaboration with the Trade Department of the United States). F. D.

931. Manuring of Tea.

I. Cooper, H. R. Rotation of Manuring. *Quarterly Journal of the Indian Tea Association*, Part II, 1924. pp. 11-118. Calcutta, 1924.

II. Wiles, H. H. Trial of Nitrogenous Manures on Tea. *Idem*, pp. 91-98, tables 4, bibliography. Calcutta, 1924.

I. A single application of manure may give a very small increase, but if continued for several years the manured area improves and a paying

increase is obtained. In the case of tea, the increased yield is produced from bigger bushes with a larger number of shoots ; a residual effect is produced which can only be ascribed to the fact that a better bush has been formed by the previous manurings.

The main requirement of tea is nitrogen, which should be applied every spring, when growth is rapid, but sufficient potash, phosphoric acid and lime must also be given and the supply of organic matter must be maintained. To meet the latter requirement an average of one ton per acre per annum of cattle manure should be given, or a green manure crop should be grown and hoed in.

The following is a satisfactory 5 year manurial rotation :

a) Slaked lime 10 maunds ; cattle manure 5 tons per acre.

b) 40 lb. phosphoric acid fertiliser on seed bed for green crop.

c) Mixture to provide 30 lb. nitrogen and 20 lb. potash per acre to be dug in round bushes.

d) 40 lb. phosphoric acid per acre ; " boga medeloa " (*Tephrosia purpurea*) to be sown in hedges and trimmed as required ; Mixture as in *c*) to be dug in round bushes ;

e) Mixture as in treatment *c*) dug in round bushes and " boga medeloa " trenched in.

The cost of the manures suggested, at present rates, would be about Rs. 22 per acre per annum, not including cost of application.

II. The article describes a trial of nitrogenous manures which has been in progress for four years at the Tocklai Experimental Station, on 18 plots planted one year from seed in 1916, plants collar pruned in 1918, unpruned in 1919 and plucked for fertility records until May 1920, when the first manures were applied, as shown in the following table :—

Manures	Yield of Tea in maunds per acre					Percentage increase or decrease on Control
	1920	1921	1922	1923	Total 4 years	
Control	9.58	7.7	7.97	8.67	33.92	
Nitrate of Soda	10.55	8.1	9.40	12.00	40.05	+ 18.07 %
Green Manure	10.01	8.4	8.45	10.22	37.08	+ 9.31 »
Oilcake	9.86	7.6	8.95	10.50	36.91	+ 8.81 »
Sulphate of Ammonia	10.24	7.5	8.09	10.04	35.87	+ 5.75 »
Sinews	9.55	7.5	7.76	9.00	33.81	— 0.32 »

No manure was applied in 1921, in order to test the residual effect of the 1920 applications.

It will be noted that the good yield produced by nitrate of soda was maintained ; the increase on the green manure and oilcake plots was not doubt partly due to the addition of organic matter to the soil, and the consequent improvement in physical properties. The quick-acting chemicals gave a heavy yield at the beginning of the season, whereas the organic manures were steadier yielders and tended to give more leaf in the latter half of the season.

The cost of producing one maund per acre increase of tea over the unmanured crop, was lowest in the case of green manured and highest with sulphate of ammonia, nitrate of soda being midway. The costs would of course vary with local conditions of soil and climate. W. S. G.

932. Trial of New Varieties of Hops.

I. SALMON, E. S. (S. E. Agric. College, Wye, England). *Journal of Institute of Brewing*, Vol. XXX, No. 8, pp. 671-689, tables, 3. London, 1924.

II. BURGESS, A. H. (S. E. Agric. College, Wye, England). Report on Work at the Experimental Oast (East Malling Research Station, Kent), in 1923. *Ibidem*, pp. 695-711.

I. Sixty new varieties of hops were tested in 1923 as to yield, and also submitted to the opinion of expert hop factors, merchants and brewers; fifteen of these new varieties gave a yield of over 1 ton per acre.

Many of the new varieties produced a higher percentage of both soft and hard resins than any of the commercial varieties tested.

Mosaic disease was less pronounced than in 1922, and the commercial variety, Fuggles, appears to be completely resistant to this disease.

II. The results of experiments carried out during 1921-1922 by the author have shown that no differences in the percentage amount of soft resins can be attributed to either the temperature at which the hops are dried, the velocity of the air current employed, or the amount of sulphur burned during drying.

The experiments made during 1923 enabled the following conclusions to be drawn:

The time to apply sulphur, in order to secure the best coloured sample is during the first two hours of drying. No difference in the rate of drying or amount of soft resin is caused by varying the time of application of sulphur.

As was shown in former experiments, the lower the temperature of drying, the better the colour of the hops. The ratio of soft to total resin is unaffected by variations of temperature; the aroma, however, is affected and the value of samples in this respect decreases with increase of temperature.

The variations of air speed had no effect on the amount of resins in the hops or their aroma.

Experiments were made to study the effect of variation in depth of hops when drying, the extremes being 2 ½ inches and 12 ¼ inches. No difference could be detected in colour and practically none in aroma.

W. S. G.

933. Oil from *Vetiveria Zizaniodes*.

GECRGHI, C. D. V. Vetiver Oil. *The Malayan Agricultural Journal*, Vol. XII, Nos. 6 & 7 pp. 197-199. Kuala Lumpur, 1924.

Roots of the perennial grass *Vetiveria zizaniodes* Stapf. have been distilled to determine the yield of oil, and valuation tests are duly reported. The yield of oil from fresh, air dried roots, is estimated at 12-14 lb. of oil

from 1 ton of roots, corresponding to about 6-7 lb. oil per acre per crop. The dark greenish brown oil obtained, has a good aroma and is of a normal character. It is used exclusively in the preparation of compound perfumes, as it acts as a useful " fixer " for more volatile essential oils.

As regards the plants, the grass appears to flourish best on light soil but will not thrive under shade. It is found also on rich marsh land. Root development is stimulated by frequent cutting of the grass. The oil content increases up to flowering time, and roots should be collected accordingly for distillation. M. L. Y.

934. *Tarchonanthus camphoratus* L. and its Essential Oil.

DE STEFANIS, C. Sui *Tarchonanthus camphoratus e sulla sua essenza, Bollettino di informazioni economiche del Ministero delle colonie*, Year XIII, No. 1, pp. 37-39. Rome, 1924.

Tarchonanthus Camphoratus L. belongs to the Compositae and is indigenous in Abyssinia, Erithrea, and Somaliland. It is a small tree with hairy leaves having a strong aromatic smell ; its branches when young are covered with felt. The wood is used locally in the manufacture of musical instruments. As regards the morphological characters of the plant, it may be noted that the older branches are woody, cylindrical and brownish-grey in colour, whereas the younger, still herbaceous branches have a distinctly stellate shape in transverse section, the white star standing out clearly against the woolly felt that covers the branch. The lower leaves have short petioles, but the upper ones are almost sessile, they are 10-12 centimetres in length and 2-3 cm. broad. Most of the leaves are oval being lanciolate-acuminate at the apex, entire, with prominent middle vein. When crushed, the leaves emit a strong smell of camphor. *Tarchonanthus* has proved on chemical analysis of dry matter to contain : water 13.35 %, total nitrogen 2.16 %, ether extract 3.75 %, essential oil 0.107 %, impure ash 8.53 %. The ash contains silica, phosphorus anhydride, sulphur anhydride, sesquioxide of iron, manganic-manganous oxide, calcium, magnesium and potassium.

The essential oil is obtained by steam distillation. Whether it can be used for industrial or medicinal purposes can only be decided by further researches. A. C. M.

935. Factors which influence the Nicotine Content of Tobacco grown for use as an Insecticide.

THATCHER, R. W., STREETER, L. R., COLLINSON, R. C. *Journal. of American Society of Agronomy*. Vol. XVI, No. 7, pp. 459-466, tables 5, bibliography. Geneva, N. Y., 1924.

Former investigations of factors influencing the nicotine content of tobacco have usually had the end in view of reducing the nicotine content so as to improve the smoking quality of the leaf. The authors' studies had the opposite aim and their work has shown that the nicotine content of

any particular variety of tobacco is largely influenced by the food supply and climatic conditions under which it is grown.

The discovery that the species *Nicotiana rustica* generally contains a much higher percentage of nicotine (about 3 : 1) than the varieties of *N. tabacum*, commonly grown for smoking purposes, has suggested the possibility that the former species might be grown especially for use as an insecticide.

Three species of *N. rustica* when grown in cultivated rows showed an average of 4.17 % of nicotine, as compared with 2.54 % when sown broadcast, without summer cultivation.

The available nitrogen in the soil is probably the most potent factor, so far as the food supply is concerned, in influencing the nicotine content of tobacco. W. S. G.

936. **Tobacco Cultivation in Palestine.**

Commercial Bulletin, Department of Customs and Trade. Government of Palestine, Vol. V. N° 57, pp. 287-294. tables 4. Jerusalem, 1924.

Since 1921, when the Palestine Government abolished the monopoly, cultivation and trade in tobacco has considerably developed. In 1921 the area covered was 1779 donums (1 donum = 0.23 acres) and rose to 5122 donums in 1923. The report reviews the varieties grown (which include Macedonian, Anatolian, Kavalla, Havana, Seres, Samsuni) and the interest shown by cultivators who have adopted scientific methods of drying; the local consumption and export figures; possible markets for the surplus Turkish tobacco; output of the four factories; transport routes. It is considered that the export trade will be increased to a large extent during the next few years; a co-operative movement has given an impetus to improved methods of production, curing and storage. M. L. Y.

937. **Recent Experiments with the Opium Poppy, and Methods of Extraction in Italy.**

CAVARA, F. and CHISTONI, A. Nuovi risaltati della coltura del Papavero da oppio nel R. Orto Botanico di Napoli. *Atti del R. Istituto d'Incoraggiamento di Napoli*, Series VI, Vol. LXXVI, Part 1, pp. 14, figs. 7. Naples, 1924.

The authors have previously drawn attention to the possibilities of cultivation of the opium poppy (*Papaver somniferum*) in Southern Italy (1) and this is confirmed in the present article. A description is given of the methods adopted in the Botanic Gardens at Naples with the white variety *P. somniferum*, and the process of extraction employed. A comparison is made between the morphine content of the Italian opium and that of other countries, and between the relative value of white and black varieties. The black poppy gave a maximum of 14.20 % morphine con-

(1) CAVARA F. and CHISTONI A. La coltivazione del *Papaver somniferum* L. nel R. Orto botanico di Napoli. *Atti del Congresso Nazionale per le Industrie Sanitarie*. Naples, 1924.

pared with 12.04 % for the white, and it is proposed to test the value of a cross between these two types, bearing in mind the advantages attached to the white type as regards size and handling.

Experiments with different forms of fertilisers and manures were made and the variation in morphine yield was found to be negligible. The superphosphate and street sweepings gave the best results (11.31 % morphine) and the calcium cyanamide alone, the lowest (7.95 %). As regards the effect of time of collecting the latex, it was found that the maximum was obtained in the morning and the minimum in the evening.

Owing to the difficulties attached to collecting the latex, a new method has been devised which has evident advantages. This consists of four Gillette blades embedded in a rectangular piece of cork, and placed parallel and at an equal level. By this means, four parallel cuts are made identically and much time is saved. This compared favourably with the lancet method frequently used.

The authors report in the appendix further results obtained during 1924 with manures, and the tables indicate the value of nitrogenous manures, (9.85 % morphine), and of superphosphate and calcium cyanamide (9.80%) with percentage of ash comparatively low. Observations were made on the effect of shape of capsule on the ash and morphine content. Of the ovoid, conical and " turban " shapes, the highest seed production was obtained from the two last types and also the ash %, although the ovoid capsule gave the highest morphine %. An experiment was made to test the comparative value for seed purposes, of seed taken from a capsule treated for latex extraction, and seed from a whole capsule. Results indicate the higher percentage of morphine in the latter case and consequently the importance of leaving a certain number of capsules untouched, to be reserved for seed.

M. L. Y.

938. **" Canudo de pito " (*Carpotroche brasiliensis*), a Plant with Anti-Leprosy Properties.**

EDWALL, G. Para curar a morphêa vamos cultivar plantas extrangeires como a chalmoogra ; os cubanos porém para o mesmo fim, queren cultivar uma planta genuinamente brasileira, o canudo de pito. *Characas e Quintaes*, Vol. XXIX, No. 4, pp. 345-346, fig. 1. São Paulo, 1924.

Carpotroche braziliensis Endl. popularly known by the names of " canudo de pito ", " pau de chimbo ", " fructa de cutia ", " fructa de macaco ", and " pau de anjo ", is a wild plant indigenous to Brazil (whence it has been introduced into Havannah, Cuba), which contains an oil with anti-leprosy properties. Like the " chaulmoogra " (*Taraktogenos Kurzii*).(1) a plant producing an oil with similar curative properties and which is now being experimentally cultivated in Brazil with a view to its acclimatisation, *Carp. braziliensis* Edl. belongs to the *Flacourtiaceae*. It is a beautiful tree and attains the height of 20 m. The genus *Carpotroche*

(1) See *R.* 1923, No. 190. (*Ed*).

grows by preference in the basin of the Amazon, and only the *brasiliensis* species has, so far, found its way down to the State of Rio Janeiro.

F. D.

939. **Papain.**

EATON, B. J. *Malayan Agricultural Journal*, Vol. XII, No. 5, pp. 134. Kuala Lumpur, 1924.

The article embodies information previously published, together with additional matter. An account is given of the source and raw products of papain, chemical analysis of the fruit, preparation of crude papain, purification, markets and sundry information from replies received to a questionnaire sent to various firms in England, Canada and America.

W. S. G.

Arboriculture and Horticulture.

940. **Libyan Date Palms.**

DE CILLIS, E. Saggio di "Fenicigrafia libica". Studi sopra alcune razze di Palma da Datteri coltivate in Tripolitania. *Bollettino di informazioni economiche del Ministero delle Colonie*, Year XI, No. 6, pp. 733-819. Rome, 1923.

The author proposes the adoption of a new word "Fenicigrafia", for the description of date-palms, after the analogy of the terms "Ampelografia" and "nicozianografia" used respectively in the cases of vines and tobacco plants.

Tripolitania is one of the richest countries of the world as regards date-palms. According to trustworthy statistics, the number exceeds, 1 300 000, in addition to palms growing in the southern oases of Fezzan and Ghat which are estimated at 4 000 000, although this figure cannot be verified. The palm grows well in association with the most different arboraceous and herbaceous plants, as well as with other individuals of its own species. There are, however, two essentially different methods of cultivating it: on ground used exclusively for growing these trees (the palm *gâba* of the natives), or mixed with other plants in the garden (*sania* method of the natives).

In gardens, the palms are usually irrigated, but the palm plantations are generally left unwatered

Palms are propagated in Tripolitania either from seed, or from suckers, the former is the natural method, but the latter is the system frequently adopted by the native agriculturist.

In specialised palm plantations, nothing is done to the soil, but in irrigated gardens it is treated in the manner required by the associated shrub or herbaceous plants. The palm trees are freed from all shoots that would deprive the stem of its necessary nutriment, and the old withered leaves falling back upon the stem are cut away. Artificial fertilisation is a necessity, as male plants are very rare. The male inflorescences used for the purpose have to be collected. The bunch of dates is carefully protected during ripening.

The time of the date harvest varies greatly according to the variety of the palm. As soon as the first dates on a bunch show signs of ripening, the bunch is cut at the bottom of the rachis and lowered to the ground by means of a rope. The crop varies with the season ; in good years, 40 kg. of fresh dates (free from the stem) is an average yield, while the maximum production is double that amount.

Since the present study is essentially agricultural in character and deals with the cultivation of the date-palm in Libya and has for its object the improvement of this tree, the author, before passing on to describe the most important varieties of the date-palms grown in Tripolitania, devotes his attention to the so-called agricultural varieties, viz. those groups of individuals possessing certain common somatic, or biological, characters pointing to special cultural qualities that remain constant in the same environment as a result of sexual propagation. It has been calculated that 620 cultural varieties exist in the zone where these trees are grown, while the names of 74 have been obtained from the oases on the coast of Tripolitania.

The author lays stress upon the great difficulty in studying the varieties of date-palm owing to the paucity or lack of information to be obtained from the growers. Since there are only three varieties which produce fruit for commerce, *boerare*, *tabùnì* and *baiiùdi*, these alone are cultivated to any great extent and are distinguished by name, the others being included under the generic appellation of *sàmmi*.

Investigations should be especially directed to tracing the origin of the different varieties with a view to discovering their kinship, for although there exists a considerable amount of literature on the subject of the date-palm, the special characters of the varieties are dealt with in very few works. Mention should, however, be made of the treatise by POPONSE, the monographs by MASSELOT and JEANGERARD, MASON'S monograph, and especially of T. H. KEARNEY'S work which, as it is a scientific systematic and descriptive study of the different varieties of date-palm, form a very important contribution to the literature treating of the subject.

The author considers the following characters of the palm stem from the diagnostic standpoint when the tree has reached full maturity : 1) height ; 2) shape ; 3) appearance ; 4) colour ; 5) the Kûrnàf.

The leaf characters are of secondary importance in the general classification of the variety, the following points being taken into account : 1) density and number of crowns ; 2) curvature ; 3) length ; 4) colour ; 5) segments : (*a*) number ; (*b*) rigidity ; (*c*) strength ; (*d*) length ; (*e*) shape ; (*f*) arrangement ; 6) spines : (*a*) number, (*b*) length.

The bunch characters to be taken into account are : 1) length of peduncle (of secondary importance ; 2) shape (of primary importance) ; 3) density (of secondary importance) ; 4) colour of stalk (secondary importance).

The behaviour of the date after gathering differs greatly in the two chief groups of varieties. In the one, it does not improve, but rather, deteriorates on keeping and cannot be used even after being dried in the sun and conserved. To this group belong the " *blah* " dates (called by the French *khalet* or *kalt*, dry or hard dates). The other group includes dates

that undergo a transformation produced by an ultra ripening due essentially to oxidation phenomena taking place in the dead pulp; these are the *Ortas*, or *rotè*, or dôgal dates, the soft luscious products of the French colonies.

There exists, however, a third class of date, that may be classed between the hard and the soft kinds as it has intermediate characters. In this third class, the pulp undergoes a certain amount of change the outer zone becoming dark-coloured and soft, although it remains more or less poor in sugar. These fruits may be called dry dates; the best known representative of this class is the "*horra*" variety.

From the point of view of the time of the ripening of their fruits, date-palms may be divided into three classes. The three periods of ripening, as determined for the oases on the coast of Tripolitania, are as follows: 1) early, from August 15 to September 15; 2) average, from September 15 to October 20th; 3) late, from October 20 to November 20.

On this basis, the special noteworthy characters of the fruits are: colour; shape; size; pulp or flesh; calyx; seed or stone.

A description is then given of ten of the chief varieties cultivated in the oases of the coast of Tripolitania, the Arab names of which are: *barùdi*, *becrari*, *brunsi*, *chadduri*, *fazzani*, *hallani*, *hammuri*, *hòrra*, *lemsi*, *tabuni*.

A. C. M.

941. The Date Palm in Egypt.

BROWN, T. W. *Bulletin No.* 43, Ministry of Agriculture, Egypt, pp. 39, plates XI. Cairo, 1924.

The author, who was formerly Director of the Technical and Scientific Service, gives a detailed description of the palm under the following headings:—

Propagation, planting, spacing, soil, manuring, intercalary crops, pollination. The different varieties are then described, viz., dry, semi-dry and soft.

The *Bulletin* is illustrated with excellent photographic reproductions.

W. S. G.

942. Thinning-Out Early Varieties of Peaches.

MANARESI, A. and BRUNORI, A. Ricerche sul diradamento dei frutti nei peschi di varietà precoce. *Le Stazioni Sperimentali agrarie italiane*. Vol. LVI. Parts 7-8-9, pp. 401-413. Rome, 1923.

Thinning-out the fruit is one of the most important questions connected with peach cultivation. The peach-tree, if well cared for, is very prolific, but the so-called "June fall" naturally reduces the number of fruits and allows larger and more valuable peaches to be obtained. This shedding of the fruit may occur before June, for it takes place as soon as the stone is formed and is sometimes due to insufficient nutritive substances and water for the production of all the seeds if the crop is a heavy one. Though it may also be caused by imperfect, or want of, pollination, or even by the agent

of plant, or animal parasites According to WAUGH, the falling of the fruit is a natural effect of selection resulting in the survival of the best fruit and the weeding-out of the peaches that are least firmly attached to the tree.

Artificial thinning-out consists in the removal of some of the fruit from the tree, but in order for the operation to be successful, the right moment must be chosen according to the variety and the more or less favourable season. Experiments conducted by BURREL in Ontario have shown that early thinning strengthens the tree and produces finer and heavier peaches. The authors mention other experiments and pass on to describe the results obtained in a large orchard in the province of Bologna from the Amsden variety of peach which is widely cultivated in that district.

The peach-orchard in question was well-adapted to the experiment as its soil was damp and fertile ; further, it had been liberally manured, and carefully sprayed and sulphured, so that the trees growing there in 1921 were regularly developed. When blossoming time came, the flowers were counted on 17 seven-yearold trees (1st group), 11 four-year-old trees (2nd group), and 12 three-year old trees (3rd group) chosen hap-hazard from the different plots. On May 10, all the little fruits present on the peach-trees were counted and the thinning out was begun, 5 cm. being left between each peach according to the local custom.

On June 4, four plants of the first group were thinned-out for the second time, about 10 cm. being left between the peaches so that the remaining fruits could have no perceptible effect upon one another. Growth proceeded regularly and the crop was gathered at the end of June when the fruit was ripe enough for sale. The results obtained may be summarised as follows : (1) the average percentage of fruits present on May 10 was 40.6 % in the case of the thinned trees as against 42.7 % in that of the unthinned. The average percentage of ripe fruits on the thinned trees was 19.5 and that of the unthinned trees was 29. This difference was 9.6 % greater than had been calculated.

(2) Fruit-shedding (" cascola ") is not decreased by thinning as is commonly believed. In fact, the percentages of fallen fruits in the case of the thinned and the unthinned trees were respectively 58.9 and 39.3. Evidently it is not possible to select the fruits that the plant will shed in the natural course of physiological processes ; further, in the case of early varieties (like Amsden) it is not possible to wait for the " June fall " before proceeding to thin-out the fruits artificially, as is recommended by American agriculturists ; (3) hence, the thinning-out of the peaches does not increase the number that will reach maturity. Thus, the average number and weight of the ripe fruits gathered were respectively : No. 411, weight 23.19 kg. for the thinned-out trees and No. 465.9, weight 24.05 kg. for the untreated trees. Therefore, the yield from the unthinned trees was the larger and the weight of the fruit of the thinned trees was too low to make up economically for the reduction in their number.

A. C. M.

943. **The Solar Propagating Frame for rooting Citrus and other Sub-Tropical Plants.**

SWINGLE, W. T., ROBINSON, T. R., and MAY, E. *United States Department of Agriculture, Department Circular* 310, pp. 1-13, tables 2, figs. 6. Washington, D. C., 1924.

Although satisfactory results are obtained in a steam heated greenhouse, where the soil temperature is maintained at 80°-90°F. and the air temperature at 70-80°F., there are many practical disadvantages attached to this method of propagation, both as regards cost of equipment and the limited period available for rooting the cuttings.

The authors describe experiments with frames deriving bottom heat from hot beds, but this was successful only for varieties which root very easily. A recent construction making use of sunlight to furnish bottom heat has been used successfully for rooting the soft-wood cuttings usually handled in greenhouses. This device consists essentially of a box, the major part of which is covered with a closely hinged glass cover. The remaining part of the box is covered by a 1 × 2 inch board through which holes are cut to admit the pots. These are dropped into the box as far as the rim. The bottom of the box may be zinc lined and filled with water to a depth of several inches or with black-painted bottles full of water. The sun's rays will thus generate a large amount of heat and this is retained by the water in the bottles at an approximately uniform temperature throughout the night. Openings at the end permit free passage of the air and prevent accumulation of heat in the upper part of the box, where it is not desired. The hinged top may be closed or opened slightly as required. Since this was tested satisfactorily in Hawaii, frames constructed on similar lines have been used in Washington (U. S.) and the results obtained for rooting citrus cuttings are very favourable. In many cases 100 % rooted successfully. The use of a solar rooting frame is naturally best adapted to countries which rely on a relatively large proportion of sunshine.

Suggested modifications have been made which should increase the efficiency of this frame: a double glazed sash 6 × 3 ft. leaving an air space of about 1 inch as a substitute for the glass border sorrounding the frame. This should prove effective in cutting off loss of heat by radiation.

M. L. Y.

944. **On the Limit of Seed Bearing in Satsuma Oranges.**

MIKI, TAIJI. Unshü Mikan no Gankaku Gendo ni tsukito. *Japanese Journal of Genetics* Vol. 1, No. 3, pp. 173-184. Oct. 1922 (Japanese).

Satsuma orange (*Citrus Unshiu* Hort.) bears parthenocarpic (seedless) fruits due to the degeneration of the pollen grain of its own, but when the flowers are pollinized with viable pollen grains of other kinds of citrus fruits, they develop into seed-bearing fruits. The range of seed contents of Satsuma fruit in cases of both natural and artificial pollination was tested at Magasaki. Three plants entomophitically pollinized bore fruits containing up to 10 seeds but never more, while about one half of the

total fruits remained seedless. Average number of seed per fruit was only 1.028 ± 0.048.

Cross pollination between Satsuma orange and 23 different kinds of citrus fruits was then carried out. Seed production in these cases was observed to be more general and slightly more abundant. About 11.3 % of artificially pollinized fruits were seedless, and the range of seed contents were between 0 and 13. Average seed contents per fruit was in this experiment 3.61 ± .116.

In conclusion, the seed contents of the Satsuma orange due to cross pollination is by no means remarkable in its extent, compared with other kinds of seed-bearing citrus fruits. Frequency and abundance of seeds contained in one fruit was slightly greater in artificially pollinized fruits than in cases where the flowers were open-pollinated. No mention was made as to apogamic seed production, which is occasionally very frequent in citrus fruits.

T. T.

945. **Flowering and Ornamental Plants in Italy.**

VAGLIASINDI, G., and MASERA, O. Piante da Fiori e da Ornamento. *Nuova Enciclopedia Agraria Italiana*, Part 5, pp. 509, plates 124, figs. 176. Unione Tip. Editrice Torinese, Turin, 1924.

This work gives a systematic account of the flowering and ornamental plants in Italy of interest to both amateur and specialist. The first part of the book is reserved for generalities dealing with soil conditions, and garden accessories, including greenhouse equipment, followed by cultural operations: (sowing propagation, selection, and acclimatisation).

The second part deals with ornamental plants from the decorative standpoint, cultivated in pots or in beds. These are classified according to special horticultural characteristics rather than the purely botanical classification; annuals and biennals ; border plants and bulbs ; herbaceous perennials and flowering shurbs ; shrubs and trees plants ; succulents ; aquatics ; hot-house plants ; orchids ; ferns ; palms (Cicadeae, etc.) ; alpine plants. In every case the description is comprehensive and should provide a very useful addition to horticultural works of reference.

The third part is reserved for ornamental plants from the industrial standpoint and deals with the cut flowers most popular on the market, for example, the carnation and the rose, the poinsettia and *Euphorbia fulgens*, violets, and certain flowering shrubs (Magnolias, Camelia, etc.). Secondly, the pot plants, including flowers, ferns, palms and evergreens, etc. followed by a full description of nursery outlay for woody plants suitable for parks, gardens and avenues, and the methods of cultivation of plants for seed purposes.

The book closes with a discussion on advisable methods of packing for market, and a useful index of the genera and species for reference purposes. The volume is well furnished with illustrations.

M. L. Y.

[945]

Forestry.

946. **Heliotropism and Geotropism in Trees and their Importance from the Forestry Standpoint.**

ENGLER, A. Heliotropismus und Geotropismus der Bäume und deren Waldbauliche Bedeutung. *Mitteilungen der Schweizerischen Central Anstalt für das Forstliche Versuchswesen*, Vol. XIII, No. 2, pp. 225-283, figs. 24, tables. Zurich, 1924.

The author passes in review the studies of HARTIG, R., SCHWARTZ, F. MÜR, E. and CIESLAR, A. on the excentric growth of wood caused by increased pressure upon certain parts of the tree. Hitherto, only coniferous trees have been considered, but the author's researches have been directed to broad-leaved trees. His investigations show that in the case of the wood of all broad-leaved trees, excentric growth in diameter is to a large extent connected with geotropic and heliotropic curvatures of the branches and trunks, even when these organs are completely developed. On the strength of laboratory experiments, botanists have hitherto maintained that only young shoots which are still increasing in length are able to bend under the influence of geotropism and of heliotropism. The author has demonstrated, on the contrary, that not only the branches, but also the trunks of old trees (the instances quoted were trees 80 years old and 30 m. high) are able to bend under geotropic and heliotropic stimulus; further, these phenomena which are of frequent occurrence in woods, are of great importance (see figs. 147-150).

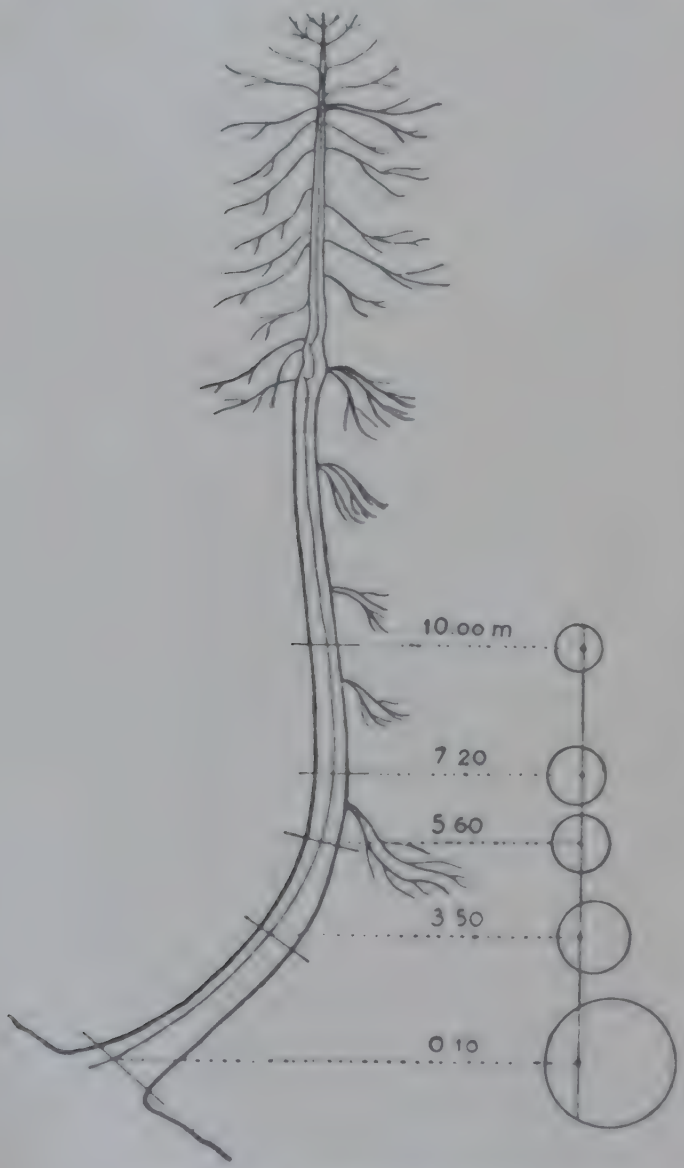


FIG. 147. — Longitudinal section of the Bergun larch.

The results of the authors work may be summarised as follows :

In the case of conifers.

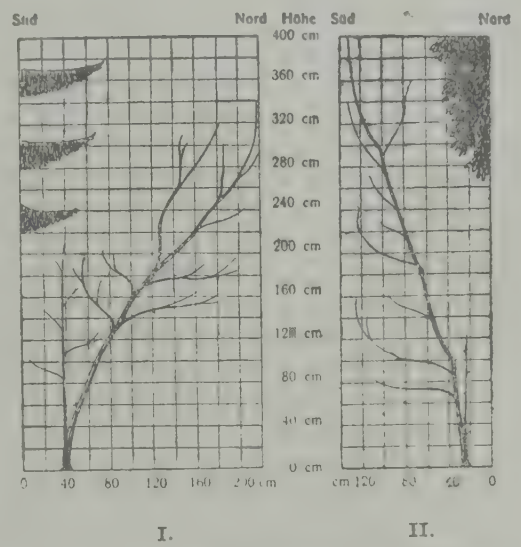
1) Not only the branches, but also the strong trunks of conifers are capable of bending geotropically, when for any cause they are placed in a slanting position. The amount of the curve depends upon the vitality and age of the tree.

2) In the case of the trunks and branches of conifers in an inclined position, there is always an increase in the diameter of the lower surface, so that an excentric section of trunk, or branch, is obtained. The wood that has grown abnormally on the lower side differs in anatomical structure from the wood of the upper surface, being thicker, heavier and generally brownish-red in colou r. This wood is the pressure-wood (*Druckholz*) or " red wood ".

3) The cause of this increased growth in thickness on the lower surface is believed to be continuous pressure, which produces greater activity of the cambium.

4) When a shoot (*Sprosse*) bends under the influence of geotropism, it increases in diameter, the difference showing on the lower surface just as in the case of the formation of the " red wood ".

5) As compared with the extension wood (*Zugholz*) formed on upper surface of the curvature, the " red wood " possesses the property of much greater contraction in the direction of the long fibres (in the case of the extension wood, the contraction is 1.287 %) ; and in the case of red wood, 0,09 % ; this phenomenon is of great importance from the biological and the technical standpoint.



I. II.

FIG. 148. — Left: Poplar at Adlisberg inclined northwards towards a stand of spruce, followed by heliotropic reaction. Right: Robinia at Adlisberg inclined southwards towards a stand of walnuts.

Curvature in broad-leaved trees.

6) Broad-leaved trees have the property of bending under heliotropic stimulus, as well as on account of geotropism. For this reason, their trunks and crowns are more mobile than those of conifers.

7) As regards increase in diameter, it has been found that broad-leaved trees react to longitudinal pressure in the same manner as conifers.

8) Geotropism produces a *very great increase in diameter on the convex side of the curve, viz., upon the upper surface* (*geotropic wood*).

Thus, contrary to what happens in conifers, geotropic wood is produced in the case of broad leaved trees upon the convex side of the curvature and therefore can easily be distinguished from pressure wood.

9) *In broad-leaved trees, the effect of geotropism upon increase in diameter is much greater than the usual effect of pressure.*

10) Where, in the case of a branch or trunk, the forces of geotropism and of pressure act simultaneously and with almost equal intensity, the diameter of the organ is increased in the horizontal direction.

11) WIESNER has introduced the following terms to describe the irregular increase in diameter on the different surfaces of the organs: epinasty, hyponasty and amphitropy, viz., increased growth on the upper, or lower surfaces, or on both surfaces respectively. These differences are explained by what has already been said.

12) We may well ask how it is possible for thick trunks of trees to bend under geotropic or heliotropic stimuli and to retain the curvature thus produced. These curvatures cannot be explained as the mere result of the cambium becoming shorter on one side and longer on the other, therefore it must be assumed that these flexions are not of an elastic, but a *plastic character.*

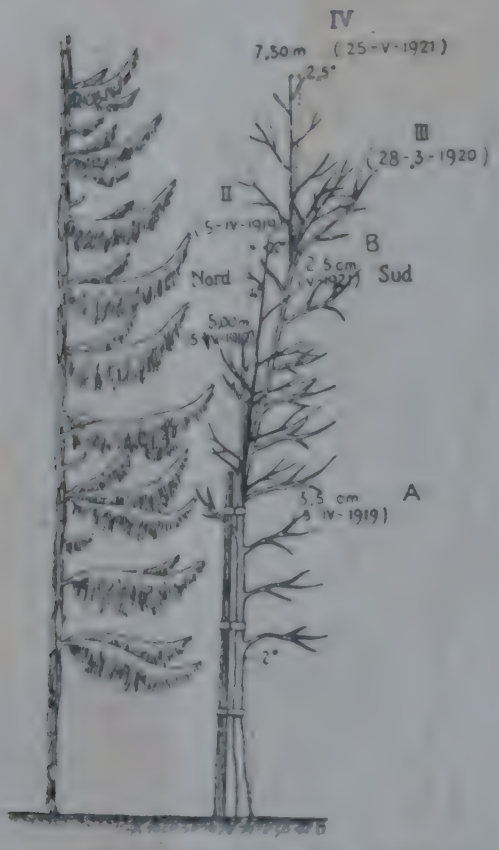


FIG. 150. — Birch in the garden of Dr Engler, inclined first towards a neighbouring spruce, followed by a speedy geotropic reaction.
A = direction of the heliotropic curve;
B = geotropic curve of a shoot.

Changes must take place in the tissue of the wood and these alterations can only consist in the substitution of an active tissue for an inert tissue on both the upper and the lower surfaces.

In an earlier work "Tropism und exzentrische Dickenwachstum" (Tropism and Excentric Increase in Thickness), the author has already stated that the living wood-parenchyma is this active tissue. The wood of conifers is relatively poor in parenchyma, which is no doubt the reason of its being less plastic than the wood of deciduous species.

Importance of these results from the forestry standpoint.

1) The knowledge of the existence and the extent of geotropic and heliotropic movements in mature wood is a most important factor that must always be taken into account in making stands of forest trees.

The forester must realise that motion is not confined to the soil organisms and the soil itself which they naturally displace, but that the crowns and the trunks of the trees also move in the air both in winter and summer.

Hitherto, it has been taught that the spaces left by cutting the branches can only be filled up by the growth of the extremities of these organs, this is however not the fact in the case of mixed stands of conifers and broad-leaved trees where the gaps are quickly filled up by heliotropic flexures

FIG. 140. — Ash 35 years old at Aldesberg, heliotropic inclination from the base upwards towards a glade of sprice, followed by geotropic reaction at about 6 m. from ground level.

2) The changes in position assumed by the trunks and branches are of special importance in the management of stands. It is possible by means of proper measures to straighten slanting or bent trees, where as the opposite result may be brought about by ill-advised thinning out.

These considerations are of great importance for stands growing on steep slopes.

3) Finally, these investigations have shown also that the properties of wood are connected with flexures of heliotropic and geotropic origin, so that in stocking woods, much importance must be given to the different conditions of growth in diameter. R. D.

947. Thinning-Out the Highest Trees.

ENGLER A. Die Hochdurchforstung. *Mitteilungen des Schweizerischen Centralanstalt für das forstliche Versuchswesen*, Vol. XIII, No. 2. pp. 255-251. Zurich, 1924.

The author gives an exhaustive study of the question of thinning-out forest, especially as regards thinning-out the highest trees, his remarks being based on the German and French literature on the subject and upon his own personal experience. The article is divided into the following chapters: historical account; studies of thinning-out made at the Swiss Forestry Stations; clearings and management; thinning-out the highest trees, from the technical and economic standpoints; present results from thinning-out experiments; the practice of thinning-out the highest trees. The following remarks of the author may be quoted:

In Germany, thinning-out the lowest trees is more common, whereas in France, at the present time, it is customary to thin out the highest, great care being taken to preserve the accessory stands. This difference can be explained as follows: the climate of Germany is generally colder and more inclement than that of France. In the latter country, the most common stands are those composed of deciduous trees of which the oak is the most valuable species. In Germany, on the contrary, conifers predominate and the danger of insects, cryptogams and fires renders it advisable to remove the dead, dry material as soon as possible. Further, deciduous trees have a marked tendency to assume bad shapes (as a result of geotropism and of heliotropism) and therefore the highest trees must be removed.

The results of the authors experiments which are given in numerous tables, show that thinning-out the tallest trees does not greatly diminish the number of trunks per surface unit, as the accessory stands are preserved. Another important point is the felling of large and very large trunks, which are removed to make room for trees that are perhaps smaller but are certainly more valuable. The figures show that stands of conifers subjected to intense thinning-out or to the thinning-out of the highest trees, produce a higher percentage of large and valuable trees than those which are only slightly thinned-out.

The author's experiments and the description of thinning-out the highest trees, show that this operation necessitates very great biological knowledge and technical skill, as well as much labour on the part of forestry staff,

therefore in spite of its real economic value this practice is not to be recommended until a new staff has been trained. K. D.

948. Percentage of Growth in the Question of Tree-Felling.

TARASCHKEVITCH, A. Проблемы правильного хозяйства в лесах Северного края (Problems of Rational Forestry in the Forests of the Northern Region). Lesnoi Journal (Forestry Journal) Nos 5 and 6 pp. 11-14. Moscow, 1924.

The serious fuel crisis which has prevailed of recent years has exercised a repercussion on every branch of economic existence, and especially upon the management of forests. For strategic reasons, to save the life of the inhabitants of the towns, or in order to sustain the industries of the country which were perishing, and to supply urgent needs, especially lack of fuel, vast tracts of woods intended for saw-timber were felled before the proper time, particularly in the most important and populous industrial centres. Further, many trees of average size were cut down while those ready for felling were left. These mistakes, which caused irreparable damage to the Governmental Forestry Administration, must be attributed either to culpable negligence on the part of the forestry staff, or to their ignorance of the principles of felling. According to the theory of forestry organisation, the annual growth percentage should show the minimum age below which all felling must be prohibited. Practically, the following rule ought to be observed: felling is permissible, when the growth percentage of the plantation is equal, or below, the growth percentage obtained theoretically by dividing 100 by the age of the plantation. The selection of plantations ready for felling has hitherto been made by means of SCHNEIDER and PESSLER'S formulae. Both these formulae are, however, unsatisfactory because they are too complicated, therefore it is very necessary to find a new method of solving the problem. Two new formulae have indeed been suggested, but owing to a misplaced distrust of innovations, they have not been practically adopted. VAN DE FLIT'S formula is based on the percentage of total growth, which is equal to three times the percentage of increase of diameter at breast-height. BOURIATCHEKS' formula which is more original, is based on the estimate of the total growth obtained by means of compound percentages. Experiments made with these formulae have shown them to be satisfactory in the majority of cases. It would, however, appear that when it is necessary to determine the growth percentage of young, rapidly growing trees (growth exceeding 10 %), it is best to use VAN DE FLIT'S formula which is more exact than BOURIATCHEK'S.

In forest valuation, the growth of a tree during the last year, of its life is never considered, owing to the difficulty and uselessness of measuring the width of the last annual ring. The average growth of the tree during the last 10 years is taken as a basis of estimation. Under these conditions, VAN VAN DER FLIT'S formula is as follows:

$$p = \frac{30\ (D-d)}{D}$$

where p = percentage of growth to be found; D = girth of tree, without bark, at breast height; d = girth of tree without bark, ten years earlier.

In conclusion, if simple easy methods of determining the growth increase of standing trees are available, it is not difficult, in each individual case, to obtain some idea of the vigour and of the age of the tree and hence to know whether, or not, it should be felled. A. B.

949. **The Valuation of Standing Forests.**

CEREBRENNIKOW, P. КВопросу об оценке леса на корню. *Лесоправ. и лесное дело*, Nos. 5-6, pp. 8-10. Moscow, 1924.

The establishment of normal reciprocal relations between the Forestry Service in its capacity of proprietor of the woods and the forestry industry, which is entrusted with the work of transforming rough timber into various industrial products, is an extremely difficult question that has to be solved by the Russian administrative authorities.

How far objectivity is necessary in the interests of the said administrative authorities can be seen from the following simple consideration.

Naturally, it is more advantageous to the timber dealer to choose the kind of tree that finds the reachest sale and is of the dimensions most in demand.

The original owners of the forest acted entirely on these lines and it is difficult to see how this system can be given up by the present trusts although since it is detrimental to the mutual interests involved, some more scientific plan of felling the trees must be devised.

The chief expenses of forest management are not due to costly buildings, or complicated machinery, but are entailed by the care and supervision of the forests which include, in some cases, planting and cultivating trees.

Therefore, some definitive agreement as to the value of the forest should be arrived at between the forestry administration, appointed by the Government, and the timber industry, which is almost entirely in the hands of the Government, in order to settle the compensation to be awarded for moneys expended in forest maintenance.

Standing forest timber is valued on the pre-revolution basis viz., according to the taxes.

The estimate should not be calculated from "the forest" (the trees when planted) but from the "consummation" that is to say from the sum of the work expended upon the forest, which determines its actual value.

In passing on to the analysis of the methods used for estimating the value of the standing timber, it is necessary to remember that the existence of markets for the wood are regulated by laws of general economy and of free competition.

Although the problem is clear as regards exportation, it is very complicated when we turn to the home market. The part played by the latter in fixing the price of forests as saleable property is constantly decreasing because the Government industry, the cooperatives, transport and wholesale consumers are all involved in the matter.

This makes it very difficult to estimate the value of the standing forest, because the forestry tax is assessed according to the market price,

and in order to determine the just value of such a forest accurate calculation and careful study of all the elements entering into the levying of the tax are indispensable.

However, owing to the friendly cooperation of the Forestry Service and the representatives of the forestry industry who possess the most complete data on the subject, it is possible to obtain certain reliable figures; although these estimates only hold good for the time at which they were made (because the taxes have not yet been fixed), and they are affected by all the changes taking place in the economic conditions of the forestry industry and trade.

To sum up: from what has been said above, we may draw the following conclusion, the correct valuation of a standing forest necessitates perseverance and intricate work, which can only be carried out by the cooperation of the Central Direction of Forests, the representatives of the forestry industry and of the two branches of the Public Services connected with the forestry question. Further, in order to solve and explain this problem to the fullest extent, recourse must also be had to the assistance of the representatives of the forestry Institutes, Colleges and organisations.

A. B.

950. **Injuries Inflicted by the War upon the Woods of Venezia Giulia.**

BUSCAGLIONE E. L'accertamento, la valutazione e la riparazione dei danni di guerra ai boschi nella Venezia Giulia. *Nuovi annali dell'Agricoltura del Ministero dell'Economia Nazionale*. Year IV, No. 3, pp. 443-488. Rome, 1924.

The damage caused by the War to the wooded pastoral region of Venezia Giulia is classed by the author under two heads: *a*) injuries inflicted in the zone of the fighting line and its immediate vicinity; *b*) those inflicted in the trench zone.

As regards the first class, the injuries are of three distinct kinds: - 1) complete destruction of the woods, accompanied by disturbance of the ground caused by field-works, or by intense bombardment; 2) the breaking or laceration, of the trunks, destruction of the trees in the coppices, removal of the vegetable-mould stratum of the soil, fires; *c*) wood-cutting by the troops, which was only a secondary matter of less importance. In the trench zones, however, the chief injuries were due to wood-cutting, forest-fires and grazing.

The author describes the measures taken by the Government for the compensation of war damage, and mentions the State Departments appointed to ascertain, estimate and make good such damage. He also treats of the reconstruction work that has been in progress for the last 2 years in the woods belonging to Public Bodies in Venezia Giulia, and concludes by stating that the afforestation of one hectare of land costs, in round figures, about 1370 lire in the Carso district of Gorizia-Sesana, and about 2335 lire in that of Trieste.

The attention of the forester is drawn to the following fundamental facts:

1) Black pine is still the best species to use in post war reconstruction.

2) When pine-woods have to be reconstructed after the war, stands of broad-leaved trees should be planted both to prepare and facilitate reafforestation with conifers and to form a barrier against the invasion of the parasites of the pine.

3) It is advisable not to attempt to replant even pines in places where trees grow with difficulty, the best plan is to reconstruct the wood in its entirety, leaving nature to fill up the gaps by gradual seed dissemination.

Neither the Scots pine (*P. sylvestris*) nor the spruce should be planted on the slopes of the Carso. A. C. M.

951. **Handbook Dealing with Osier Cultivation and the Osier Industry.**

ALOI, L. I vimini. *Coltivazione ed industria*, 16°, pp. XVII + 311, figs. 165. Milan, U. Hoepli, 1924.

This handbook is published by the Institute for the Encouragement of Small Industries (*Istituto per il Lavoro e per le piccole industrie*) which has its headquarters in Venice and is engaged in developing the small agricultural industries of Italy.

The book deals chiefly with the riverine district of the Piave (the ancient Marca Trivigiana). The author reviews the present conditions of the wild osiers, and of the osier-trade and industry and states the means and outlay necessary for the systematic cultivation of the wild osier beds, for improving the plaiting industry and organizing a trade in the products thus obtained. The handbook has been written as a means of propaganda to encourage osier-growing. The author considers the question not only from the point of view of his own observations and studies, but from information collected from practical osier-experts.

The first part of the book contains information required in order to plant and cultivate an osier-bed successfully: studies of the different varieties of willow, means of distinguishing them apart — soils suitable for willows-rules for planting — cultural operations — protection against plant and animal parasites — the preparation of the products for sale and the best marketing methods.

The second part of the book is intended to serve as a guide to the apprentice basket-maker and as an aid to the expert hand. It shows how the measurements, shape and weaving of baskets may be improved, describes the different stages of the work and gives designs of articles that find a ready sale or are distinguished by their elegance. The descriptions are easily followed on account of the many figures given in the text.

The author concludes by suggesting a scheme for the organisation of National School for Osier Growing and the Osier Industry and also quotes some of the most important answers received to an enquiry sent through the Treviso Chamber of Commerce to many merchants in North Italy suggesting the institution of a National Association of Osier-workers.

F. D.

952. **Present Day Technique for Drying Timber.**

DESCHEVOI, M. Современная техника сушки лесных Материалов. *Лесопромышленное Дело*, Nos. 1-2, pp. 31-34. Moscow, 1924.

In the timber trade, air heated by means of a stove, or by steam is the only agent employed for drying wood. Theoretically, the air passing into the drier should be raised to the maximum temperature obtainable, while the air passing out should be completely saturated. In point of fact, however, these extreme limits are of no advantage. Indeed, at a high temperature, air which has been completely saturated on its entrance into the heating apparatus becomes too dry, having a moisture percentage of barely 5, so that the moisture of the wood is removed too quickly, especially if the timber is damp, with the result that the surface becomes dry and forms a layer which prevents evaporation from the interior. This is the chief cause of splitting, particularly in the case of hard wood that parts with its moisture slowly. The high point of saturation hinders drying and the circular shape of the log frequently becomes irregular.

There are various ways of preventing wood splitting during the drying process; in the first place, the tendency to split can be greatly reduced by working at an initial low temperature (35°C. or 40°C.), or by gradually and slowly raising the temperature of the desiccator up to a maximum of 60°-70°C. The drier the wood, the higher the initial temperature that can be used and the more rapidly it can be increased to the maximum. The surface of the wood may be damped in order to preserve the elasticity of the fibres in the external layers.

Another way of preventing the wood splitting is to maintain an equal amount of air always circulating in the desiccator.

The air that has been used in the desiccator may also be passed through a cooling apparatus before it is returned to the heater; by this means some of the steam absorbed from the wood by the air escapes and becomes condensed. Practically however, it is best to change the air periodically. Both these processes are much in use in America whence they have found their way to Europe. The American Forest Products Laboratory has published a series of tables, embodying the results of many different experiments, showing the normal course of the drying process for every type of American wood, and how satisfactory results can be obtained in each particular case. The present method of drying wood in America consists in using very damp and sufficiently heated air at the beginning of the operation, and then gradually decreasing the moisture content and raising the temperature towards the close of the process. This avoids any danger of splitting because at first, the moist air has the same effect as steam. On the other hand, as the process is carefully supervised and regulated, evaporation takes place very regularly and therefore a valuable product is obtained.

The air in these driers is saturated to the required degree by means of the introduction of more or less dense jets of water into the tube containing the drying agent. The latter is heated by steam pipes placed outside, or inside, the drier. A draught is created by ventilators, or suction pipes, working under the pressure of the steam introduced.

Attention should be given to driers on the form of tubes, charged in succession, to insure uninterrupted work. The points to be considered in selecting a drying system are as follows. No matter what method is adopted, the testing of the process is an essential condition of success. At the present time, there are a number of testing instruments to be had.

It is necessary to determine : 1) the degree of moisture required in the desiccator at every stage of drying : 2) the degree of the moisture of the drying agent ; 3) the temperature of this agent at all times and in every part of the desiccator ; 4) to maintain the humidity automatically or the temperature of air for a given time.

The apparatus used by the Americans are accurate and are scientifically handled, those employed in Russia are, however, of primitive construction and as they do not admit of adequate control, the results obtained from them are unsatisfactory. A. B.

953. **Note on the Strength, Treatment and Durability of Sain (*Terminalia tomentosa*) Sleepers.**

SEAMAN, L. N. and KAMESAM, S. (Forest Research Institute, Dehra Dun). *Indian Forester*, Vol. L., No. 6, pp. 298-314, tables 4. Allahabad, 1924.

The object of the investigations carried out by the authors was to obtain data on the strength, elasticity and spike-holding power of *sain* timber.

The results of the tests showed that the mechanical properties of *sain* are more than sufficient to meet the requirements of the very best wooden railway sleepers, being superior to those of White Oak, one of America's finest sleeper-woods. The spike-holding power of creosoted *sain* sleepers is extremely good.

Sain (*Terminalia tomentosa*) is a very strong wood found in almost all parts of India and Burma. In Burma, Bombay and Madras the timber is available in large sizes and quantities. The Chief Conservator, Bombay, estimates that about 7 500 B. G. and 75 000 M. G. sleepers will be available from the Bombay forests annually, for some years to come.

The average life of the untreated timber when in use on the railway is only from 5-7 years, whereas after treatment under pressure with a mixture of creosote and earth oil (7-8 lb. per cu. ft.), the life of the sleepers is about 15 years, the same as that of a Nepal *sal* sleeper.

Assuming an amortisation rate of 6 %, the cost per mile per year of treated *sain* is Rs. 2409, whereas, the corresponding figures for the two standard woods, *sal* or *pyinkado*, are Rs. 2537 and 2533 respectively. W. S. G.

954. **The Wooded Massifs of the Caucasus and Their Importance in the Development of the Export Trade.**

RODER K. E. Des massifs boisés du Caucase et de leur importance dans le développement de l'exportation. Лѣсные массивы Кавказа и ихъ значеніе въ развитіи лесоэкспорта, лѣсопромышленное дѣло, Nos. 3-4 pp. 23-25, Moscow, 1924.

The forests of the Caucasus are composed of about 300 species of trees and cover some 6 913 200 dessiatines, hence they provide an inexhaustible source of valuable timber for the supply of the markets of the world.

The broad-leaved trees found there include: the beech (25.8 %), oak (21.2 %), hornbeam (21 %), while conifers are represented by the pine (8.3 %) and the fir (0.7 %), other deciduous trees such as the ash, maple, elm, white poplar, wild cherry, pear and others occupy about 1.5 - 5.6 % of the wooded area. The Caucasus is also rich in various valuable trees not found in the forests of European Russia.

The chief characters of the above-mentioned trees are as follows:

The pine (8.3 %). There are 6 species of this tree, the Scots pine (*Pinus sylvestris*) is the most common; it reaches a height of about 100 feet with a diameter of about 2 feet, at the age of 150 to 200 years.

The Caucasian fir (*Picea orientalis*) (0.7 %). — This chiefly occupies the mountainous region where it grows to a height of about 100 feet. The wood, although softer than that of the fir of North Russia, makes good saw timber. Some individuals of this eastern fir are of special value on account of the resonance of their wood, which is much in demand for the manufacture of musical instruments.

Abies normanniana, the Caucasian fir, (0.1 %) reaches the height of about 200 feet with a diameter of about 4 1/2 feet. The wood is soft and light being inferior in quality to fir, or pine wood except as a source of cellulose, for which purpose it is superior as its fibres are long and soft.

The most important of the *Cupressineae* is the tree-like juniper (*Juniperus excelsa*), which has a wood equal to that of the Virginian juniper, being resistant, resinous, of average hardness, close-grained and reddish in colour. It does not bend easily and is little subject to worm attack. It is very suitable for making pencils and can be used for this purpose as a substitute for Virginian juniper, or Florida cedar. The species of broad-leaved trees supplying the best timber for export are as follows:

Beech (25.8 %). There are two varieties of this tree: the common beech (*Fagus sylvatica*) and the riental beech (*Fagus orientalis*). The wood of the oriental beech is lighter in colour than the product of the common beech: the colour is white with reddish-grey shadings, and possesses valuable properties for building under water, being second only to oak in this respect. It can also be used for furniture (especially for making Viennese bent-wood furniture) and in the manufacture of clogs, boot-trees and gun-stocks. The wood of the oriental beech is easy to chop, saw and plane and takes a stain well, so that it makes an excellent imitation of walnut and other valuable woods. It is also largely used for flooring the interior of rooms, railway-carriages and cabins. On distillation, the beech yields charcoal, tar, acetic acid, wood-spirit, paraffin, creosote and guaiacol. Finally, it possesses great heating properties and takes the first place among the woods used as fuel.

The oak (21.2 %). There are eight varieties of this tree to be found: the winter oak (*Quercus sessiliflora*) the sumach oak (*Quercus pedunculatus*), the hairy oak (*Q. pubescens*), the Armenian oak (*Q. armeniaca*) and the chestnut-leaves oak (*Q. castaneifolia*). The latter sometimes attains very large proportions, and grows 100 ft. in height with a diameter of 7 ft. The oak furnishes the best building timber, for it is hard, resistant, elastic and splits with difficulty, but regularly. Oakwood does not plane

or polish easily but can be split relatively without difficulty. It is chiefly used in the manufacture of furniture, flooring, carriages, telegraph poles, etc. It is also the best wood for making the hulls and submerged portions of wooden boats.

The hornbeam (*Carpinus betulus*) (13 %) has a white, close-grained, very heavy, hard, wood that splits with difficulty and bends but little as a result of drying ; it soon decays however under water, or even in damp places. This wood is employed in turning and carpentry and is an excellent fuel for heating.

The ash (*Fraxinus excelsior*). The wood of this tree is hard, coarse-grained, ductile, splits with difficulty, but is much subject to worm-attack ; is not easily planed, its elasticity prevents breaking readily ; takes the mordant well. Ash wood is used for carpentry, furniture-making and carriage-building. The wood of the young tree is used for oars and skis.

The maple. Nine species of maple are found in the Caucasus of which the chief are : 1) the sycamore, (*Acer pseudoplatanus*) which has a white wood with yellow lights ; it is veined and spotted with numerous fine birds-eye markings, the fibres are thin and dense, the wood is close-grained, hard, rather light, rigid, but easily cracked and relatively durable. It splits well, gives thin shavings when planed, does not bend, and polishes well. It is used for inlaid-work in cabinet-making and for boxes for optic instruments, as well as for lined measures, boot-trees, plates, cups, spoons, toys, bowls, etc. 2) *Acer platanoides* (the plane) has a light red wood that is often prettily veined and is fairly hard, but easily cracked. *Acer campestris* (common maple) has a close-grain with long fine veins, but is not very strong or resistant and its technical qualities are much inferior to those of sycamore wood. *Acer montanus* (the grey mountain maple) is the most valuable of these species ; the wood is extremely close- grained and has greyish-green lights and is artistically veined. Grey mountain maple is chiefly used in the manufacture of high-class furniture.

The elm. The most important species of elm are : 1) the mountain, or wych elm (*Ulmus montana*) which has a rather heavy wood of average hardness and with long fine fibres, it has a greyish ground dotted over with oblong red patches ; is easy to work, but polishes badly and is little subject to worm-attack ; is used in carriage-building, the manufacture of furniture, for turning, in making wind-mill sails, and for the submerged parts of boats. 2) *Ulmus suberosa* (the "karagatch") has a coarse-grained wood ; the heart-wood is brownish-red, while the sap-wood is yellowish. This wood being softer than that of *U. montana*, retains the shape imparted to it for a longer time. The heart-wood is handsome and is much used both for furniture and in carpentry and building.

The false acacia (*Robinia pseudo-acacia*) supplies a rather hard, very elastic wood, of handsome appearance for the colour varies according to the way the light falls ;— it takes the mordant well and bends easily. This wood is extensively employed in furniture-manufacture, carriage-building and carpentry and makes excellent building timber, for it is hardly affected by exposure to the air and does not become rotten in the ground.

The birch: Three varieties of this tree are found: the common birch (*Betula verrucosa*), the hairy birch (*B. saddeana*) and *B. medwedewi*. These are all different from the botanical point of view, but furnish a similar wood that closely resembles that of the birch of North Russia.

The alder: these are 2 species of alder in this part of the Caucasus: the black alder (*Alnus glutinosa*) and the white alder (*Alnus incana*). Alder-wood is soft and flexible and liable to worm-attack. It is heavier than pine wood, splits and planes easily. If exposed to the air, it does not last long but under water, like oakwood, it is very durable and is therefore much used in hydrotechnical installations. It is employed for making cigar-boxes for export.

The poplar. The chief species of poplar growing in the forests of the Caucasus are the aspen (*Populus tremulas*), which provides excellent wood for matches: the black poplar (*P. nigra*) largely employed in furniture mak- ing, and the white poplar (*P. alba*), which can be used in the manufacture of common furniture. G. B.

955. **The Forestry Question in French West Africa.**

MANGIN, M. (Inspecteur des Eaux et Forêts). La Question forestière en Afrique Occidentale Française. *Comptes Rendus des Séances de l'Académie d'Agriculture de France*, Vol. X, No. 20, pp. 379-387, Paris, 1924.

M. MAURICE MANGIN, who has just returned from visiting the various Colonies in French West Africa, speaks very strongly on the subject of the general deforestation he observed though to a different extent, in all these countries.

Everywhere, the forest stands are abandoned without any attempt at protection, to devastation and wanton destruction at the hand of man (clearing by the natives, brushwood fires, grazing, improper felling by the Public Services, colonists, exploiters of forests, etc.).

In the Colonies in the North of French West Africa, after the land is left bare and after it has been cleared of trees by shepherds and agriculturists, the fertilising elements of organic origin are dispersed and nothing remains but a barren steppe of which the extent continues to increase. Not only do the gradually disappearing stands of forest trees cease to furnish wood (even fire wood), to supply the pressing needs of the country, but what is still more serious, they fail to carry out their indirect part in the natural economy.

Hence, the climate is changing, the rainfall is decreasing and becoming irregular. Throughout the regions whose wooded condition has remained unchanged, the rainfall has not altered, as may be seen at Dakar, Rufisque and Tomloucton, whereas wherever there has been any deforestation, the rainfall has diminished in proportion to the extent of the area cleared. Thus, it is only 20 % less at Kayes where few trees have been cut down, but has fallen 45 % at Kaédi, 38 % at Podor and 25 % at Saint Louis where the woods of the entire range of Gonakiers have been felled. The duration of the river floods often a factor of fundamental importance to agricultural prosperity, has also been changed. The author especially

studies the instance of the river Senegal which when it overflows its banks only inundates the alluvial valley for 3 or 4 months, while the land on the river banks benefits from the flood waters for 6 to 8 weeks if it is 1 metre in height, for 2 to 3 weeks if it reaches 2 metres in height, and remains uninundated at higher levels.

Further, the sand is reported to have made considerable advances so the desert is extending further towards the south. The Sahel, both in Mauritania and the Sudan, was formerly much more wooded and hence better irrigated and more thickly populated than at the present day. The loose sands set free by the disappearance of the acacia stands, which bound it together, have now resumed their march under the action of the north-west wind and have already extended to a noticeable extent towards the south-west. Nothing but a chain of forest reserves can hinder their further progress.

In short, deforestation has reached the point of destroying the equilibrium between the factors determining the climate and the hydrographical conditions of the country, thus imperilling its agricultural future.

R. D.

LIVE STOCK AND BREEDING.

General.

956. **Goitre in Animals.**

Moussu, G. Du goitre chez les animaux. *Journal d'Agriculture pratique*, Year 87, Vol. II, No. 48, pp. 431-434, figs. 5. Paris, 1923.

Goitre is the term applied to a hypertrophic lesion of the thyroid glands which shows itself in the form of one or two swellings that make their appearance on the normal site of the glands.

If the lesions are slight, the swellings are not at all apparent. In the case of animals, these lesions seldom occur and when present are generally separate and distinct.

The character of the goitre is variable, sometimes the gland simply increases in volume without any change taking place in its internal structure, but frequently the abnormal development of the follicles of the thyroid glands leads to cystose degeneration; in other cases, tumours of very variable consistency develop at the expense of the gland and its tissues.

The horse appears to be the domestic animal most often attacked by goitre, old horses being especially subject to this affection. The disease is very seldom met with in cattle, but goitre is fairly common in sheep and goats when, they are quite young, and it even attacks newly-born individuals. In such cases, the pathological condition is directly inherit-

ed from one or other parent, but the actual and primary cause is unknown.

Goitres of whatever character interfere with the functioning of the neighbouring organs, the extent of their effect depending on the volume and weight of the swelling. The functional disturbances that always accompany goitre irrespective of the alteration in glandular structure, are however the most serious symptoms.

The thyroid glands direct the growth of the young individual until the latter attains the weight and conformation proper to maturity and they continue to play a part of the greatest importance after that period, since they help to keep the composition of the nutritive medium (the blood) in a normal condition.

The thyroid glands are therefore of the highest importance in organic development, and goitre must at all times be regarded as a serious affection; indeed whenever this alteration of the thyroid glands is present, growth disturbances are produced, or in the case of adults, the responsive functions become affected and lack of muscular energy, apathy and indolence result.

Experiment has proved that dwarfs and idiots can be produced by the removal of the thyroid glands. In adults, their excision causes asthenia, viz., muscular impotence. Excessive functioning of these glands due to the increase in volume of the organs without any alteration of their tissues may occur, or what is more common, the activity of these organs is decreased owing to a change in the tissues of which they are composed.

The physiological disturbances are just opposite in the two cases, but are always very prejudicial to the health of the organism.

In the case of animals, there can be no question of curing the patients, for the disease necessitates a long difficult treatment and careful supervision, or else serious surgical operations.

In short, an animal affected with goitre, is in a condition of more or less marked and intense organic inferiority and is of no use on the farm. In no case, should individuals suffering from this disease be employed as breeding-animals however excellent their conformation may be.

P. D.

957 **Decubitosis and the " Lamziekte " of South Africa.**

Van Medert, L. La décubitose et la " lamziekte " de l'Afrique australe. *Annales de Gembloux*, Year 30, No. 5, pp. 166-167. Brussels, 1924.

There exists in the Transvaal a disease known as " lamziekte " which much resembles decubitosis, a disease met with along the coast of Texas and which every year carries off many head of cattle.

In South Africa, " lamziekte " (cattle paralysis), is most severe during the dry season, a time when the cattle suffer from osteophagia, another phase of the disease called *Pika*, which consists in a depraved appetite. Dr. Theiler has come to the conclusion that " lamziekte " is due to want

of phosphorus in the ration since no animal given a superabundance of organic phosphorus has ever been known to contract the disease.

In Texas, decubitosis rages all along the low-lying coast area, whereas in the Transvaal, " lamziekte " is prevalent even in the high plateaux of the Veldt. Decubitosis is unknown in wooded pastures ; or in the enclosures where the cattle are fed, it attacks by preference bulls, although these animals show little tendency to contract " Pika ".

According to Dr. THIELEN, animal carcases decomposing in the air harbour 3 different species of bacteria which secrete a toxin that kills any animals chewing the bones, scattered on the prairie.

In the Transvaal, it is now forbidden by law to sell bones that have not been previously disinfected by steam. It is advisable to supply bone-meal to the breeding-stock, as this prevents osteophagia and the resulting " lamziekte ". Cattle given bone-meal grow more rapidly and are free from osteomalaxy and rachitis.

Spreading superphosphatic fertilisers on the pastures also prevents " lamziekte ".

The only means of stamping out decubitosis and " lamziekte " is the burying, or burning of all carcases without removing them from the place where they lie. P. D.

958. **Foot-and-Mouth Disease in Sheep.**

MOUSSU, G. La fievre aphteuse chez le mouton. *Journal d'Agriculture pratique*, Year 88, Vol. 1, No. 7, pp. 128-130. Paris, 1924.

Foot-and-mouth disease rarely occurs in adult sheep, or goats, in the severe form in which it attacks cattle; further, it is seldom accompanied by the characteristic symptoms. Owing to foot-eruptions being the best-known and frequently the only manifestation of the disease in sheep and goats, foot-and-month disease is in their case often confused with foot-rot.

When mouth lesions appear in these animals, they take the shape of small vesicles of short duration that arise on the pad, or on the inner surface of the lower lip. Copious salivation, which always occurs in cattle, is seldom present and the sick animals only exceptionally suffer from total loss of apetite.

The foot lesions are, on the other hand, more characteristic in sheep, although the vesicles are often limited to the spaces between the digits and rarely extend to the external circumference of the hoof, or to the heel region.

If numerous abortions occur during a few weeks in ewes in an advanced state of gestation, this trouble is due to foot-and-mouth disease and not to contagious abortion ; in the same manner, a high mortality among the lambs of a few days old that show no pathological symptoms, is to be attributed to foot-and-mouth disease.

Unlike foot-rot which develops slowly in one sheep after another, so that a long period elapses before a large number of individuals are attacked, foot-and-mouth disease is extremely contagious and though its

effects are slight in the case of adult sheep, the lambs born during the course of an outbreak of the disease die off in large numbers from a septicemic form of the disease which is not accompanied by apparent lesions, or vesicles, in the mouth, or on the foot. Lambs born of dams that have just had foot-and-mouth disease benefit by the immunity acquired by the ewe before lambing.

It is possible to prevent the loss of the young animals if foot-and-mouth disease is prevalent during the lambing season, or a little after. The blood, or blood-serum of individuals that have lately recovered (a few days or even some weeks previously), like that of hyperimmunised animals, possesses preventive and curative properties. Therefore, blood taken from animals that have recovered, if kept uncoagulated, can be injected into infected individuals, or newly-born lambs, with the result that they frequently remain immune, or in any case, contract the disease in a benign form; 50 cc. of blood from animals that have recovered is a suitable dose for adult sheep and 15-20 cc. is sufficient to insure lambs from infection.

A veterinary is required to take the blood and make the injections. P. D.

959. **The Hereditary Resistance of Poultry to the Diphtheria Bacillus.**

FRATEUR, J. (Professeur à l'Institut de Zootechnie de Louvain). Note sur la resistance héréditaire de la volaille à la diphtérie bacillaire. *Annales de Médecine Vétérinaire*, Year 69, Nos. 8 and 9, pp. 336-372. Brussels, 1924.

These experiments were begun with 5 hens and 1 cock. Two of the hens (Nos. 140 and 150), had proved resistant, while the 3 others had shown themselves to be susceptible as had also the cock (No. 153). The latter was mated with the 5 hens, and the experiments were continued on the offspring. In order to judge of their resistance, or susceptibility, the birds were inoculated in the mucous membrane of the mouth; they were isolated in the observation pens and kept together throughout they whole experiment.

The following crosses were made:

I. *Cross between susceptible × susceptible parent types.* — From mating cock 153 with the 3 susceptible hens, 9 chicks were obtained 8 of which were susceptible and 1 resistant. Further experiment proved that the latter bird must be regarded as susceptible, for its resistance was only phenotypic.

II. *Cross between resistant × susceptible parent types.* — The same susceptible cock was mated with two resistant hens. The 17 chicks thus obtained were all resistant.

III. *Intercrossing of the F_1 chicks obtained from the cross resistant × susceptible* (in 2). — This $F_1 \times F_2$ cross produced 9 birds, of which 7 were resistant and 2 susceptible, which shows a segregation of monohybrid dominants (3 : 1).

IV. *Re-crossing the F_1 birds obtained from cross resistant × susceptible (of 2) with susceptible individuals.* — In order to test the results of experi-

ment 3, the F_1 resistant heterozygous individuals were recrossed with recessives. By this means, 13 susceptible and 10 resistant birds were obtained; these figures recall ratio: 1) resulting from crossing monohybrid F_1 individuals with a parental recessive. The results of 3) and 4) prove the existence of a dominant factor of resistance R. whose absence causes susceptibility to the diphtheria bacillus.

V. *Reciprocal Crosses.* — The resistant hen of 1) was mated with a F_1 cock and produced 4 chicks of which one was resistant and 3 were susceptible. Two of the susceptible individuals were mated with susceptible cocks and produced 5 descendants all of which were susceptible, thus proving that the apparently resistant fowl was in reality susceptible.

Finally, 4 susceptible individuals were the total issue of F_1 individuals derived from the susceptible × susceptible cross of 1).

General Recapitulatory Table.

Nature of Cross	Results	Results
I) rr × rr	+ + + + + + + + +	—
II) rr × RR		— — —

the Arabs give the tick-infested cattle pills made of barley pounded in a mortar, kitchen salt being added in the proportion of 200 gm. per 2 kg. barley. The animals readily take the salted barley. In the treatment for adult cattle 1 kg. (200 gm. per day) are necessary, while 500 gm. (100 gm. per day) are enough for calves. From the first day, the dead or dying ticks begin to fall out, and on the fifth day the animal is quite free from the parasites. The sodium chloride is directly absorbed and passes into the blood, of which the salt content rises progressively as is shown by the following instances

1st animal: sodium chloride reaction of blood = 6.380; after taking 150 gm. sodium chloride, reaction = 6.728.

2nd animal: reaction = 5.467; after 8 days treatment, 6.844

The explanation of the treatment is that the ticks are poisoned by the salt contained in the blood they suck from their host. This method has proved equally effective in the case of horses, but in order to administer sufficient salt to kill the ticks, it is necessary to introduce an oesophagean tube into the nostrils of the horse.

P. D.

961. **Influence of Asparagin and of Ammonium Nitrate on the Nitrogenous Metabolism of Ruminants.**

STARZEWSKA M. (Institute of Animal Physiology and Feeding at the University of Jaquellonne, Cracow). Owptywie asparaginy i azotanu amonowego na wymiane azotawa zwierzecia przeŕiwajacego. *Roczniki Nauk Rolniczych*, Vol. X, Year 3, pp. 528-544, bibliography, tables 6. English summary. Poznan, 1923.

The author used an adult sheep in his experiments to determine the effect exerted by asparagin and ammonium nitrate upon nitrogenous metabolism

The chief results of his experiments may be summarised as follows:

1) Asparagin added to a ration poor in digestible protein has a favourable effect upon nitrogenous metabolism in ruminants;

2) Nitrate of ammonium, if employed in the same way, behaves similarly. A complete analogy has been found between the behaviour of ammonium nitrate in the authors experiments and that of sodium nitrate in BOGOZÍNSKI'S experiments.

3) The unretained part of the nitrogen obtained from the asparagin and the ammonium nitrate was eliminated in the urine in the form of urea.

4) The similar behaviour of the asparagin and of the ammonium nitrate in the organism of the ruminant would seem to show that these two substances undergo the same changes in animal economy. Probably ammonia is a common intermediate product of both the compounds studied

P. D.

962. **The Productive Value of Stock Foods.**

SPITZ, G. (Professeur à l'école supérieure d'agriculture et vétérinaire de Rio de Janeiro). La valeur productive des aliments du bétail. *Comptes rendus de l'Académie d'agriculture de France*, Vol. X, No. 3, pp. 75-81. Paris, 1924.

I. *Productive value in body-fat, or fattening value.* — Taking as his basis the results of KÜNH and KELLNER'S experiments which proved that 100 kg. of pure starch added to the maintenance ration of adult cattle that were not working produced an average of 24.8 kg. of body-fat, the author calculates the theoretic fattening value of any forage, with the help of the following formula :

$$\text{Fat} = \frac{24.8 \times \text{n. starch units}}{100} = 0.2448 \text{ starch units.}$$

(one starch unit represents the starch value of the forage calculated according to KELLNER'S method).

Net energy value. — The term fattening value is only used in connection with the foods given as a supplement to the maintenance ration ; therefore the amount of energy corresponding to the fat formed represents the *total available* energy derived by the organism from this food.

The author calculates this energy by multiplying the fattening value by the calorific equivalent of fats, viz., 9.4.

When the animals are not being fattened, this energy, instead of being stored up in the form of fat, would be applied to some other useful purpose or would simply be used in the working of the vital organs, or the maintanance of the organism. It forms what the author calls the *net energy value of the food.*

The author shows that the value of the net energy can be obtained, without deriving it from the fattening value, by multiplying the net starch value of a forage by the coefficient 2.33 ($0.248 \times 9.4 = 2.33$) which gives the calorific equivalent of the net starch. This figure differs little from the energy value of pure starch (2.17-2.20) as found experimentally by ARMSBY with the respiratory calorimeter.

M. SPITZ afterwards gives an instance of the practical application of his method to the determination of the comparative value of 3 forages that he studied in Brazil : *Andropogon rufus, Cynodon Dactylon,* and *Panicum numidianum.*

Prof. DECHAMBRE who laid this work before the *Académie d'agriculture de France* deduced the following conclusions from it :

1) the *productive value* of stock feeds, whether expressed in terms of body-fat, (*fattening value*) or of energy (*net energy value*) gives the measure of their actual efficacy.

2) The method advised by M. SPITZ is as accurate as KELLNERS' method and possesses the additional advantage of expressing the useful effect of foods in function of actual production, or of the energy represented by the latter.

3) When completed by the knowledge of the digestible protein con-

tent, it allows of the application of the experimental data acquired to the solution of problems of rationing, or the substitution of foods in a manner that is sufficiently accurate for all practical purposes.

4) It forms an accurate term of comparison between the various foods regarded from the standpoint of economical production and for the estimation of their true commercial value.

5) The *fattening value* only applies to the foods making up the production ration ; the *net energy value*, on the other hand, shows not only the energy available for maintenance, but also the energy that can be used in production, or for any other stock-breeding purpose.

6) The productive value and the starch values based on experiments made in fattening cattle, can strictly be applied only to this class of animals. The productive value may however be extended to growing cattle, and dairy cows, or even to sheep and horses. The productive value in the case of swine is different, being higher, at all events, when concentrates are given.

P. D.

963. Rice Hulling and Polishing Residues as a Stock Feed.

P. C. Les déchets du travail du riz dans l'alimentation du bétail. *Bulletin économique de l'Indochine*. Year 28, pp. 80-81. Hanoi, April, 1924.

A summary is given of Signor R. CHIAPPELLI's study on the utilisation of the by-product of rice, known as "pula del riso" (*rice-bran*). This has the appearance of a more or less coarse flour which is moist and greasy and has a pleasant smell and taste. In colour it is generally yellow, but sometimes takes on a brownish shade, and is composed of the exterior of the mesocarp, the embryo and a small quantity of broken rice. This bran has a high food value, for it is rich in protein and fat and also contains a considerable proportion of starch and fibre.

As regards the digestibility of the protein, the fat and the N-free extracts, KELLNER and KICHU found by feeding experiments on working oxen that the percentages of these substances were respectively 71.87 and 90.

Average chemical composition of rice bran.

Water	13.6 %	Crude fat	14.25 %
Ash	10.33 %	Fibre	13.25 %
Crude protein	11.62 %	N-free extracts	36.87 %

The only disadvantage possessed by this bran is the large amount of fat it contains. The fat, on being broken up by the lipolytic enzymes, produces acidity in the mass which may occasion gastric disturbances in animals.

It is advisable to choose the least rich bran cakes with the lowest fat content as these keep longest and have the best fat protein ratio, so that they can safely be fed in larger quantities to live-stock.

Rice-bran cakes can be fed dry, or as a mash or paste; if given moist, however, they must be prepared just before use.

The amount of cake, or rice-bran, given per head and per day depends upon the food to which it is added, 4-6 kg. being regarded as an average quantity. R. D.

964. **Utilisation of Brewers' Grains.**

DRUMMEL, L. Utilisation des drèches de brasserie. *Le Cultivateur belge*, pp. 13-14. Brussels, 1924.

Brewers' grains are composed of the husks of barley that have been used in beer-making and are moistened with a certain amount of water.

Composition of brewers' grains.

	According to WOLFF	Average of 3 analyses made by the author
	—	—
Water	76.10	74.52
Ash	1.20	1.59
Albuminous matter	5.30	4.89
Fat	1.50	1.67
Fibre	4.00	5.12
Carbohydrates	11.90	12.23

WOLFFS' figures can therefore be used for calculating rations.

Brewers' grains have long been used as a stock-feed, for although they contain much water, they are very nutritious. (1 kg. brewers' grains = 2 kg. beets) and eaten with avidity by animals. They give excellent results in rearing young stock, during lactation, and in fattening. Sows in farrow eat brewers' grains readily. This feed is given alone, or mixed with other substances. The following are types of rations that may be fed.

Dairy cows (500 *kg.*)

Brewers' grains	20 kg.	Brewers' grains	12.5 kg.	Brewers' grains	18 kg.
Hay free of clover	5 »	Shorts	6.5 »	Dry lucerne	6 »
Cottonseed cake	1 »	Wheat bran	3.0 »	Bean meal	2.5 »
Oat-straw	5 »	Straw	4.5 »	Chopped straw	4.0 »

Swine (25 kg. live-weight).

Butter milk. 1 1/4 l.	Malt germs . 375 gm.	Potatoes'. . 1.250 kg.	Potatoes . . . 1 kg.
Potatoes . . 1 1/4 kg.	Palmnut cake 200 »	Skim milk . 1.250 l.	Brewers' grains 0.750 kg.
Bean meal . 1/4 kg.	Potatoes. . . 750 »	Brewers' grains 0.750 kg.	Butter milk 1.750 l.
Brewers' grains 1/2 kg.	Brewers' grains . 50 km.	Malt germs . . 0.250	Rye. . . . . 50 kg.

Owing to their high water content, brewers' grains quickly decompose. They can be kept in the fresh air for several days, provided they are cooled as quickly as possible. When necessary to keep them for a longer time, they must be put into the silo, pressed, or dried.

P. D.

Demonstration of Food Value of Milk.

REED, O. E. and HUFFMAN, C. F. (Dairy Section, Michigan Agricultural Experiment Station) *The Creamery and Milk Plant Monthly*, Vol. XIII, No. 8, p. 46. Chicago, 1924.

In order to show the food value of milk, the following experiment was carried out at the Michigan Agricultural Experiment Station, the animals used being 4 Yorkshire pigs of the same litter and of nearly the same weight. The animals were divided into two lots.

Lot I: fed shelled yellow maize + skim-milk for 5 months.

Lot II: given shelled yellow maize + water for the same time. The maize was placed in a self-feeder. Lot I was given as much milk as the animals could consume during their two daily meals. All the animals were weighed every 10 days.

At the end of the 5 months of the experiment, the pigs of lot I had gained an average total of 100 kg., whereas the average live-weight gain of lot II was only 4.393 kg. This great inequality was due to the "growing power" of skim-milk. There was also a striking difference in the health of the two lots; further, lot I was evidently satisfied by the ration fed while lot II showed an abnormal desire, on every opportunity to eat pebbles and slag, thus proving the ration to be insufficient.

The pigs of lot II were subjected to another 5 months' experiment with a view to determining the food value of skim-milk and the effect of an arrest of growth upon later development.

One of the pigs (7 months old and weighing 19.500 kg.) was given shelled maize and skim-milk, the other pig, which was of the same age and weighed 21.750 kg., received shelled maize + water + complete mixture of mineral substances. The latter were added to the ration in order to prove that the lack of mineral substances in the ration of lot II had not been the cause of the great difference between lot I and lot II.

At the end of the second 5 months' period of experiment, the pig fed maize and skim-milk had gained 139.07 kg. and had entirely made good the arrest in its development, while the pig given maize + water + mineral substances had only gained 12.684 kg.

The latter animal when it was 12 months old and weighed only 34.428 kg. was given a ration of shelled maize and skim-milk. After 5 months of this diet, it gained 124.122 kg. in live-weight. This gain was not due only to an increase in fat, but also to the development of the skeleton and the muscles.

This not only proves the food value of skim-milk, but also that an animal can make up for an arrest in development due to improper feeding if it is given the right food before the growth impulse has ceased to act.

In conclusion, we may state that milk is a complete food which furnishes energy by means of its fat and sugar, supplies protein material for muscle formation, and is at the same time a source of the mineral

matter required for bone-development and of the vitamines that are the accessory factors of growth. P. D.

966. **Digestibility of Red Herrings and their Value for Milk Production.**

ISAACHSEN, H. J. Den salte silds fordøielighet og verdi i melkprodukzjonen. 16 *de Meddelse fra foringsforsøkene ved Norges Landbrukshøiskole* 1922, *Meldinger fra Norges Landbrukshøiskole*, No. 1, pp. 47-60, 17 graphs, English Summary. Christiania, 1923.

The chemical composition of red herrings is very variable. The following averages were obtained from the analysis of 12 samples : dry matter : 45.4 %; protein (estimated as true protein), 14.6 %; fat 9.1 % ; ash 19.7 % ; salt : 17.7 % ; other organic substances : 2 %. Of the total dry matter, 32 % was composed of protein, 20 % of fat and 39 % of salt.

As the salt content is very high the herrings should be soaked in water before using them. By soaking the fish in cold water for 30 hours, without changing the water, 13 % of the protein and 59 % of the salt were dissolved. The herring absorbs the water in which it is immersed, therefore its weight remains much the same ; 1 kg. of soaked herrings contain a rather smaller amount of nutritive elements than before treatment but the food value of the dry matter is increased by the removal of the salt.

Experiments on the digestibility of the product were carried out on two sheep fed whole fish and cleaned fish. The average digestibility coefficients thus obtained were as follows : organic matter : 86.6 ; protein 98.5 ; fat : 83.1 ; ash (salt) : 95.4. By means of artificial digestion with pepsin + hydrochloric acid the average digestibility coefficient of the protein was found to be 19.

The productive value of the herrings was determined with 8 pairs of dairy cows (using the group method) and with 17 cows (period method) : 100 kg. of herrings weighed before soaking, but fed after soaking, had the value of 46.3 food units, or 1 food unit per 2.2 kg. of soaked red herrings. Allowing for the losses during soaking (13 % of the protein) it may be estimated that 100 kg. of unwashed herrings is worth 49 food units, or 1 food unit per 2.1 kg.

This estimate does not take into account the fall in the fat content of the milk that may be caused by the herrings. If this is reckoned, 2.2 kg. of red herrings contain 1 food unit.

Red herrings have a variable effect on the fat content of milk according to the places where the experiments are conducted. Sometimes the fat percentage is greatly reduced, whereas at others, it remains unchanged. As a rule, however, the experiments proved the fat percentage of the milk to have been reduced.

By comparing the theoretical value with the value found by experiment, the starch value of herrings was estimated as 95. In these tests, however, the herring meal with which the herrings were compared was assumed to contain little salt, but to be of full starch value ; further no account was taken of the possible reduction in the fat content of the milk. Now that the amount of this loss of fat is known, we may safely estimate the average starch value of red herrings at 92. P. D.

967. **Inspection of Commercial Feeding-Stuffs.**

Bulletin 209, pp. 44. University of New Hampshire, U. S. A., 1924.

The Bulletin was compiled by the Commissioner of Agriculture for the State Department of Agriculture, in 1923. The first 12 pages deal with the quality of feeding-stuffs, classification, meaning of chemical analysis, digestibility of foods, method of using tables in making up cattle feeds, suggestions in purchasing feeds, etc. The remainder of the book is entirely composed of tabulated analyses of practically every feed used for cattle, pigs and poultry. W. S. G.

968. **Multiple Gestation and Twins.**

DECHAMBRE, ED. De la gestation gémellaire et des jumeaux. *La Revue de Zootechnie, revue des éleveurs*, Year 3, No. 6, pp. 411-417. Paris, 1904.

By the term multiple gestation is understood the simultaneous production of several young by a female belonging to a species that is usual uniparous. The production of twins is due to abnormal circumstances and the animals born under these conditions have certain special physiological characters of which the most striking is frequently an exact similarity in external appearance. CORNEVIN estimates the proportion of twin births in the case of some domestic animals as follows: mare, one twin birth out of 1000; ass, one out of 100; cow one out of 80. Ewes often drop twin lambs and there are some breeds of sheep (for instance, the Caux breed), which regularly produce twins as a result of selection with this object in view. It has been found that an animal which has on one occasion produced several young at a birth, is likely to do so again, and further, that the number of the offspring tends to increase at each succeeding birth. GILLIVRAY mentions a cow that dropped one calf in 1842; three calves in 1843, four again in 1843, two in 1844; three in 1845; six in 1846; two in 1847; and four in 1848, viz., 25 calves in 7 years.

If the pedigree of twin-bearing females is examined, it is often found that some of their ancestresses were also multiparous; indeed, twins are predisposed to produce twins. Thus multiple gestation is an hereditary character.

Another remarkable fact for which no explanation has been found is that males have the power of begetting twins. In the case of thirteen ewes served by the same ram there were 1 single birth, 8 double births, 3 triple, and 1 quintuple, whereas the same proportion of multiple births did not occur in the rest of the flock which was served by other rams.

Twins may be bivitelline, or monovitelline. At the moment of heat, it may happen that two ova are present in the uterus at the same time having come from one, or from both, of the ovaries. If these ova are fertilised, twins are produced, but in this type of twin, the individuals are no more intimately connected than any other two brothers or two sisters, for since the ova have been separately fertilised, the young may even be the offspring of two different fathers and bear no resemblance to one another

because their simultaneous birth is due to chance ; such twins are known as accidental, or bivitelline, twins.

In another case, as a result of influences that have not been determined, the same ovum gives rise to two embryos that will become true, or monovitelline twins. The two beings thus produced are absolutely identical in their external aspect, have the same ancestral inheritance and, from the physiological standpoint, are a single individual. This explains the facts that monovitelline twins are of the same sex and resemble one another to an extraordinary extent. This similarity extends even to the intimate organisation of the two individuals, the same congenital troubles, or malformations, are found in both twins which may even suffer at the same age from similar diathesic disturbances. The exact similarity of monovitelline twins is useful when it is a question of recognising animals by means of epidermic markings, for it is probable that these will be identical in both twins. This does not, however, detract from the value of this method of identification for only two absolutely identical individuals could be substituted for one another ; further, the fact that the animals are twins can be easily noted at birth.

If the twins are of different sexes they are certainly bivitelline, but if they are of the same sex, they may be monovitelline, or bivitelline. The amnion of the envelopes decides the question : one amnion and two cords, or two amnions but one chorion = univitelline twins.

Two distinct chorio-amniotic sacs = bivitelline twins. The study of the foetal envelopes has afforded an explanation of the fact that in the case of twin cattle, one calf is often sterile and sometimes its genital organs present anomalies. M. LILLIE examined 41 cows' uteri containing 2 embryos : 20 times the foetus were of the same sex, while 21 times they were of different sexes. In nearly every case the chorion had established vascular connections between the foetus. Each time such connections existed and the sexes of the foetus were different, the ovaries of the female were atrophied. Under other conditions, these organs remained normal, as was observed in 3 cases out of 31. The author concludes that the blood of the male contains hormones which prevent the normal development of the female reproductive organs and when it circulates through them gives rise to sterility and its consequences : genital malformations, and masculinism.

In birds, two classes of twins are found : bivitelline twins produced from eggs with two yolks, and monovitelline twins hatched from eggs with one yolk. These two classes arise in two ways and it is possible that these methods also exist in the case of mammals, but owing to the reduced size of the mammalian ovum, it is difficult to follow them. We must either suppose the yolk to possess two cicatricules each giving rise after fertilisation to an embryo, or to have only one cicatricule which produces a double embryo. The embryos that develop on a single yolk may be equal, or unequal, one being normal and the other somewhat abnormal. At first, the embryos remain isolated, but later, at the time when the umbilical vesicle penetrates into the abdominal cavity, they may be united by means of their umbilici and give rise to an ompholagous monster caused by the union of two twin individuals.

The study of the production of twins among birds throws light upon the embryology of higher animals, since from the physiological standpoint the egg of the bird is comparable in every respect to the mammalian ovum, while it has the advantage of being much more easily studied.

P. D.

969. **Tunisian Live-Stock.**

Le cheptel Tunisien. *Annales de l'Institut Colonial de Bordeaux*, pp. 81-82. Paris, Bordeaux, March, 1924.

This article gives the statistics of the last livestock census in Tunisia and contains a description of the chief species of domestic animals.

The Tunisian horse belongs to the Barbary breed, or to the class of Arab-Barbary derivatives. It has valuable qualities being thrifty, hardy, and enduring.

The same variety of donkey is to be found throughout the whole of North Africa; the animals are small, thrifty, hardly and solidy-built. On account of the difference in the animals used for mule-breeding, the Tunisian mule is not of a well defined type: its height varies from 1.30 m. to 1.50 m. Some individuals are small, thin, and scraggy, while others are large, muscular and well filled-out. The oxen of the country are excellent work animals and have also a marked aptitude for fattening, finely-finished oxen giving a meat yield of 47 to 50 %. The Tunisian cows are poor milkers, but this is attributable to the climate rather than to the breed.

The native sheep belong to the fat-tailed Barbary breed, they are hardy and furnish excellent mutton, their meat yield varying from 40 % to 47 %. The Tunisian goat resembles the Nubian goat and when well fed, gives about 1 litre of milk per day.

The Tunisian pig is a variety of the Iberian breed; it is very hardy and well adapted to open-air breeding. Pork yield 75 % of live-weight.

There are two races of dromedaries in Tunisia, of which one supplies pack-animals and other riding-camels. The pack-dromedary varies in height from 1.60 m to 1.90 m., it is thrifty, hardy and enduring. The " mehari ", or riding-camel, is very thrifty and very resistant to fatigue.

The Government has to combat various contagious diseases that attack the live-stock, foot-and-mouth disease, rinderpest, dourin and rabies being the most prevalent.

The prophylatic direction of stock-breeding is assisted by the Arloing Institute which carries out researches on contagious diseases, and manufactures and distributes vaccines, serums, etc.

The following measures have been adopted by the Government for encouraging and improving horse-breeding. Prizes are awarded to the owners of animals worthy of distinction; a Pony Studbook for Tunisian ponies and those derived from the Barbary breed has been started; a grant has been made to the French Remount Station which places at the disposal of horse-breeders, 121 stallions from its depôt of Tebourba, the animals being divided among 26 Stations at the Service season.

The State keeps a certain number of Pyrennean jack-asses which are lend to breeders at the service season for the production of mules suitable

for agricultural work. The offspring obtained by crossing these asses with native mares are very satisfactory.

Zebus of various origins have been introduced for the improvement of the Tunisian cattle, while Merino and thin-tail Algerian rams have been imported to improve the native sheep breeds.

Finally, with a view to the co-ordination of the work, the Government has established the Breeding Station of Sidi-Tabet where technical, practical and economic experiments are conducted, in order to obtain the necessary experience for directing stock breeders in the improvement and management of the native races, and to supply them with information respecting the acclimatisation of foreign breeds with the object of their direct exploitation, or of crossing them with the native animals. P. D.

970. **Draft Animals in the Philippines.**

SHARP, M. *Hoard's Dairyman*, LXVII, No. 24, p. 845, figs. 5, Fort Atkinson, Wisconsin, 1924.

The animals generally used for draught purposes in the Philippines are "carabaos", or water-buffaloes, and Indian cattle (called "*vacas*" in Spain). The carabao is well adapted to heavy work. It is a short, heavily built, powerful animal with a slow pace well suited for the tillage of the damp muddy soil of rice-fields.

The water-buffalo is also largely used for transport purposes, the normal load under draft being one ton of produce on a small two-wheeled cart. Not infrequently, caravans of 25 to 30 carabaos are met taking rice, coconuts and other produce to the markets. The name "water-buffalo" has been given to these animals because, during the hot hours of the day, they like to immerse themselves in water, leaving only their heads above the surface.

The water-buffalo is only used for milk production to a very limited extent. A carabao cow if properly fed can give as much as 3 kg. of milk (containing 7.5 % fat and 20 % solid matter) per day.

The inhabitants of the Philippines, however, depend chiefly upon goats for their milk and dairy products.

Dairy cows imported into the islands have done very well except when they have fallen victims to rinderpest. As a serious campaign has been started against this disease, it is hoped that in the future dairy, cows and beef cattle will occupy an important place in the agricultural industry of the country.

The carabao is also a butcher's beast but the beef is rather tough.

The water-buffalo lives chiefly on grass, some concentrates being added during the working season. As a rule, the coat of these buffaloes is black or dark brown, although white individuals are sometimes seen. The price of carabao varies from 150 to 300 *pesos* (1 *peso* = 2.59 fr. at par). In the agricultural colleges of the Philipines, much attention is paid to breeding and selecting water-buffaloes for draught purposes, a scale of points being employed similar to that used in the United States for draught horses.

The carabao seems to be indigenous to the Philippine Islands for

wild specimens can yet be met with in uninhabited parts of the country; some persons, however, believe this buffalo to have come from China.

Another very important draught animal is the "vaca" which resembles the Jersey as to colour, but is of a different size and general type, being broader on the whole and having heavier fore-quarters. The "vaca" is chiefly used for traction and ploughing on rough ground; its country of origin is probably China. The "vaca" is used for beef production and also for milking, for though the female does not give much milk it is superior in this respect to the carabao.

No heavy draught horses can stand the climate of the Philippines, but hundreds of little ponies, similar to Shetlands, are used both for riding and driving. They afford a practical cheap and comfortable means of getting about and are harnessed to small two-wheeled carriages known as "carromatas". P. D.

Special.

971. **The Genetic Cycle of the Horse; the Hypothetical Genealogy of the Horse.**

LUKOMSKI BOLESLAW. Hipotetyczna genealogja konia. *Roczniki Nauk Rolniczych*, Vol. IX, No. 3, pp. 561-571, table 1. French summary. Poznán, 1923.

All animal forms are the products of the conditions of the soil and climate. When animals are transported where other conditions obtain, they are obliged to adapt themselves to their new environment, or else they perish. The horse is a striking instance of this natural law.

The Bashkhire of the Urals is the horse which most nearly resembles the wild species and it may be regarded as the prototype of the domestic horse. This primitive type penetrated into all parts of the world, being modified in the East into the Mongol pony, in the South into the pure-bred Oriental horse, and subsequently in Europe into the English thoroughbred. Finally in the North, it became the Scandinavian pony, an animal intermediate between the Mongol and the heavy forms of the Dutch horses. The half-bred is the link between the two stocks: viz. that of the pure-bred Oriental and of the Western horse respectively.

Thus we arrive at the following cycle of types:

I. Prototype (Bashkhire horse)

Mongol pony

B. II Scandinavian pony	A. II Kalmuc horse
B. III a and b. light draught	A. III Caucasian horse
B. IV Draught	A. IV Pure-bred Oriental
	A. V Pure-bred Western horse

B. A. and A. B. Half-bred horse

P. D.

972. Measurements of the Pied-Black Plain Breed of Cattle of Greater Poland (Province of Poznán).

KONSPIŃSKI, T. Badania zoometryczne nad bydłem czarno-białem nizinnem Wielkopolsce. *Roczniki Nauk Rolniczych*, Vol. X, Year 3, pp. 570-597, tables 6, figs. 6, graphs 2. English Summary. Poznán, 1923.

During the summer of 1923, the author measured 159 plain cows of the East Friesian type. All the animals in question were registered in the Herdbook of Poznán which includes the 3 following States: Przyborówko, Gasawy and Chrustowo. The soil is most fertile in Chrustowo and least fertile in Pzyborówko. It appears that where the soil is most fertile all the measurements, except neck length, are reduced.

The results of the measurements, expressed in terms of the arithmetic mean (A), type deviation (O) and variation coefficient (V) are as follows:

	Nos.	*A*	*O*	*V*
Length of head (total)	159	52.7	1.9	3.7
Length of head from muzzle	159	49.7	2.5	5.03
Length of forehead	159	23.2	1.28	5.5
Breadth of forehead (narrowest part)	159	17.3	1.048	6.0
Breadth of forehead (widest part)	159	21.0	1.109	5.2
Width between horns	159	16.4	1.049	6.33
Width of muzzle	151	15.2	1.954	12.8
Length of horns	157	21.9	—	—
Circumference of horns	157	15.1	—	—
Height at withers	153	132.4	2.267	1.7
» at croup	153	133.7	2.961	2.2
» at root of tail	153	133.7	2.908	2.2
» of legs at point of shoulder	138	70.0	2.582	3.68
» at knee (pisiform bone)	129	36.4	2.42	6.66
» at hock	129	50.1	3.56	7.1
Circumference beneath knee	148	19.0	1.353	7.12
Total length of animal	159	204.0	3.7	1.8
Length of body measured horizontally	159	152.0	4.687	3.07
» » body measured obliquely	148	161.0	5.24	3.24
» » pelvis	148	52.0	1.908	4.23
» » tail	143	84.3	—	—
Width of chest above the shoulders	148	44.4	2.601	5.8
Depth of chest	145	71.3	2.763	3.8
Distance between points of haunches	129	55.0	3.243	5.8
» » points of croups	129	35.0	2.626	7.6
» » pelvic bones (diameter of pelvis)	129	53.6	2.03	3.78
Girth of chest	159	186.5	6.538	3.5
Girth of abdomen	159	196.0	5.021	2.56

Summary of Correlation Coefficients.

Total length of head and length of pelvis	$r = 0.81$
Total length of forehead	$r = 0.6$
Height at withers and length of fore-limbs	$r = 0.4$
» » » » oblique length of body	$r = 0.37$
» » » » depth of chest	$r = 0.41$
» » » » girth of chest	$r = 0.31$
» » » » width of pelvis	$r = 0.37$
» » » » length of pelvis	$r = 0.27$
Width and depth of chest	$r = 0.287$
Length and width of pelvis	$r = 0.36$
Length of croup and distance between points of the croup	$r = 0.7$
Length of body (oblique) and depth of chest	$r = 0.17$

P. D.

973. Rate of Milk Secretion as Affected by an Accumulation of Milk in the Mammary Gland.

RAGSDALE, A. C., TURNER, C. W., and BRODY S. (Dairy Husbandry Department, University of Missouri, Columbia, Missouri). *Journal of Dairy Science*, Vol. VIII, No. 3, pp. 249-254, table 1, graphs 2, bibliography. Baltimore, 1924.

The object of the present study is to show the effect on milk secretion caused by an accumulation of milk in the mammary gland and to prove the advantages of the frequent milkings advised by dairy experts.

In their experiments, which lasted about three months, the authors used 2 Jersey and 2 Ayrshire cows. The experiment period was divided into sub-periods of 3 days experimentation and 3 days rest.

The animals were milked regularly morning and evening at 5 o'clock. During the first sub-period, there was an extra milking at 6 o'clock in order to obtain the milk secreted during the first hour. During the second period, the extra milking was done at 7 in the morning, so as to get the milk secreted during the two hours subsequent to the regular milking; this method was continued till the 36th hour, the regular 5 o'clock morning or evening milkings being suppressed when necessary.

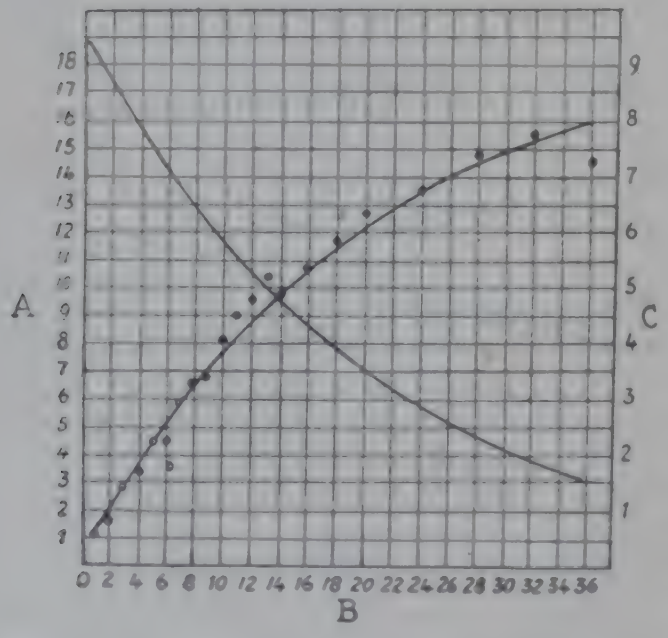


FIG. 151. — Rising curve represents total milk obtained at the end of the time interval shown; the declining curve represents the milk secreted per hour at successive intervals, each hours milk production, 95 % of production succeeding hour.

A = milk secreted during entire interval; B = hours after last milking; C = milk secreted per hour.

Figure 151 shows the results obtained and allows the following conclusions to be drawn:

1) The rate of milk-secretion per time unit is regulated by the amount of milk accumulated in the mammary gland, or by the length of time intervening between the two milkings. If the amount of milk secreted in the course of the first hour is represented by 100, the amount secreted during each of the following hours is approximately 95 % of the milk secreted in the ocurse of the preceding hour.

2) The curve representing the amount of the milk secreted follows the same course as a curve showing a chemical reaction where the reaction products are not removed; this proves milk secretion to be a chemical process that obeys the ordinary laws of physical chemistry.

Under the experimental conditions, it was estimated that a cow which is milked three times daily will give 110 % of the milk secreted by a cow that is only milked twice daily; while a cow milked four times daily will yield 116 % of the milk obtained from a cow only milked twice daily.

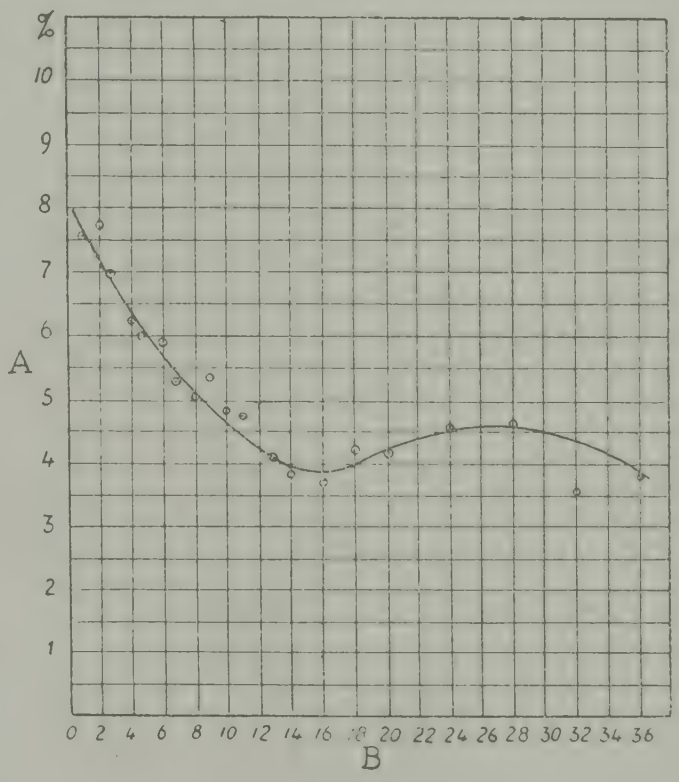


FIG. 152. — Curve shows a gradual decrease in the % of fat in the milk at varying time intervals following the preceding milking.

A = fat; B = hours after last milking.

Figure 152 shows the effect produced on the fat content of milk by the length of time intervening between two milkings.

The data prove that the fat percentage and total solid matter content fall with the prolonging of the interval between two milkings, provided the time does not exceed 14 to 16 hours. After that length of time, there is a gradual increase up to 36 hours.

Other data collected at the Station would, however seem to show that there is a connection between the fat-content of milk and the time that has elapsed since the animal has been fed, and that this relation, rather than the interval between the two milkings, is the factor accounting for the variation in the milk composition.

P. D.

974. **Effect of Incomplete Removal of Milk from the Udder.**

DAVIDSON, F. A. (Department of Dairy Husbandry, University of Illinois, Urbana, Illinois *Journal of Dairy Science*, Vol. VII, No. 2, pp. 197-203, tables 15, graphs 16, bibliography. Baltimore, 1924.

The author begins by giving the results of previous experiments and lays stress on the importance of completely removing all the milk from the udder before beginning milk control. A table and a graph show the results of leaving a certain amount of milk in the udder.

The incomplete removal of the milk causes a marked difference in the percentage composition (lactose + protein + ash) of the milk produced during subsequent milkings, and a return to normal conditions is very gradual. The fat percentage, however, increases considerably and is highest after the milk has been re-introduced into the udder at the time of the second milking.

The details of an experiment are given which lasted 4 months and was conducted to ascertain the effect produced upon the quantity and composition of succeeding milkings, by leaving a certain quantity of milk in the udder. In the test were used, 12 pure-bred cows (5 Holsteins, 3 Jerseys, 3 Guernseys and 1 Ayrshire), ranging in age from 2 years and 11 months to 12 years and in the first to the ninth month of lactation. The experimental period was divided into 10 sub-periods.

In the first experiment, 4 cows were employed (1 of each of the above mentioned breeds); the animals were milked at stated hours twice a day, the milk being weighed, sampled and analysed to estimate the fat content, lactose and solid substance percentage after each milking. The experiment was extended to 19 tested milkings 8 of which were regarded as forming a preliminary period. At the 15th milking $\frac{1}{4}$ of the average milk usually yielded was left in the udder (the estimate being based on the 7 preceding milkings), and the 4 succeeding milkings were compared with the 8 preliminary milkings.

In the second experiment, a similar procedure was followed, except that there were only 17 milkings of which 8 composed the preliminary period. At the 13th milking, over $\frac{1}{2}$ of the milk yielded on an average at each milking (calculated on the basis of the 6 preceding milkings) was left. In the 8 following experiments, the usual official test method was adopted, viz the cows were milked 4 times daily. Each of these experiments lasted 4 days and included 17 tested and sampled milkings. The first 8 preliminary formed the preliminary period. After the 9th milking, $\frac{1}{2}$ the average amount of milk drawn was left in the udder (based on the 4 preceding milkings).

The 8 following milkings were considered the same as those of the semi-official tests and compared with the 8 preliminary milkings.

At the beginning (during the 2 first milkings), the butter fat was determined by the BABCOCK method, the lactose by polarimetry, and the total solid matters by weight. In the next 8 experiments, the same methods were employed except that the fat was determined by the RÖSE-GOTTLIEB method.

From the results of the experiments, shown in 17 tables and 15 graphs, the following conclusions may be drawn :

1) The average milk and butterfat yield and the average fat percentage of the milk tended to increase during the 2 days of the test.

2) The average lactose content decreased.

3) There was little variation in the protein + ash content of the milk.

4) The degree of the changes taking place in the composition of the milk during this time depended upon : *a*) the amount of milk left in the udder ; *b*) the length of time this milk remained in the udder before complete milking.

5) The decrease in the lactose content of the milk was not sufficient to be revealed by estimating the sugar, but was enough to cause the suspicion that the milking had not been complete.

6) In the same manner, the various changes taking place in the composition of the milk collected during 2 days did not suffice of themselve to prove the deception, unless there were some data showing the composition of the milk yielded before the incomplete milking. P. D.

975. **Correlation Betwen Amount of Milk Produced and Fat Percentage of Milk.**

Konopiński, T. Współzależność miedzy zswartościa Atuszczu Womleku a ałośeia mleka. *Roczniki Nauk Rolniczych*, Vol. X, No. 2, pp. 218-241, tables 13, bibliography, English summary, Poznán, 1924.

Since 1894, the literature dealing with cattle selection has contained different opinions on the subject of the correlation existing between the percentage of butter-fat and the amount of milk produced by an animal. Careful calculations have recently been made with a view to determining the correlation of these factors. The results which have been published do not agree, but they usually show a negative correlation of the amounts produced, though sometimes the correlation is shown to be positive.

The author has tried to solve the question by means of the statistical method and his calculations have doubled the statistical data available for the purpose.

On applying the statistical method to the results obtained, it appears that the average of all the calculations hitherto made is $r = -0.1865$. Thus, a correlation exists, but it is negative.

This result has been obtained from the examination of the milk and butter-fat records of 32 126 cows divided into 28 lots containing from 89 to 3564 animals. P. D.

976. **Results of Experiments on Dairy Cows in Denmark.**

Frederiksen, L. Foreløbige Oplysninger om nogle Forsøg med Malkekoor i Vinteren 1922-23. *Meddelelse fra Forsøglaboratoriet Husdyrbrunings-afdeling, udgivet af den Kgl. Veterinaer og Landbohøjskoles Laboratorium for landøkonomiske Forsøg*, pp. 1-40, 1 graph. Copenhagen, 1923.

Different quantities of foods and of protein. — These experiments include 3 series, *a*, *b*, and *c*.

Series a Constant amount of food (1/3 forage unit per kg. of milk) *Different protein content* 50, 40 and 60 gm. net digestible protein per kg. of milk. Three farms; in the case of one of the farms, two groups *A*

Group	Amount of net digestible protein per f. u. and per 3 kg. of milk
A	150 gm.
B	120 »
C	180 »

The cows fed normal rations are placed in group *A*, those receiving less food in group *B* and the most liberally fed animals in group *C*. By "normal ration" is to be understood: a *maintenance* ration of one forage unit (containing 50-60 gm. net digestible protein) for every 125-150 kg. of live weight and which is varied according to the condition of the cow. For every 3 kg. of milk (of normal fat percentage) is added, in the production ration, one forage unit containing about 100 gm. of net digestible protein. The amount of food given was altered according to the fluctuations of the milk, the quantity of the substances being changed every fortnight on the basis of the daily milk yield of the cow during the past fourteen days. The variation in the amount of protein was obtained by altering the ratio of the cake and cereals fed the different groups: On an average, the forage and concentrates were given in the following proportions to the various groups:

A 66 per 100 cake and 34 p. 100 cereals
B 47 » » » » 53 » » »
C 86 » » » » 14 » » »

It was necessary to see whether the variations in the amounts of cereals, or of cake, had any effect upon the cows employed in the experiment. It was found that all the cows gave practically the same amount of milk containing the same percentage of fat: group *A* 148.2, group *B* 145.9, group *C* 149.6 kg. of milk per 100 forage units. One cow of this series gave an average of 2.5 kg. of milk per forage unit of production ration.

The reduced amounts of protein were apparently sufficient to insure the same milk yield. It should, however, be remarked that 60, 40 and 50 gm. of net digestible protein per kg. of milk were not given to the cows as was first intended. When the milk yield decreased, the food reduction was carried a little late and instead of 60, 40 and 50 gm., the cows were given on an average 58.7, 46.8 and 69.9 gm. of net digestible protein per kg. of milk.

Series B. Constant protein content 150 gm. net digestible protein per kg. of milk) Varied rations (50-150, 50-180 and 50-120 forage units per kg. of milk.

Three farms. — In one of these farms there were two *A* groups.

Group	Content of net digestible protein
A	150 gm. per 3 kg. of milk per f. u.
B	180 » » 3.6 » » » » »
C	120 » » 2.4 » » » » »

On an average, lot *A* received 54.7, *B* 55.4, and *C* 53 gm. of net digestible protein which was a little more than had been intended.

If the total amount of food is calculated in proportion to milk production : group *A* gave 149.7 kg. of milk per 100 forage units, *B* 168.7 and *C* 138.0. Per forage unit of production ration, *A* gave 2.42, *B*, 2.86 and *C* 2.07 kg. of milk. In all three experiments, group *C* gave the highest milk yield, but *B* (the group least well fed), was also superior to *A* in milk production.

The least increase in yield was obtained from *B* and on two of the farms, this group lost heavily in live-weight. It is to be supposed that the normal group *A* received a sufficient ration in proportion to its milk yield. Groups *A* were fed on an average 10.06 forage units a day and yielded 15.1 kg. of milk.

Groups *B* received 9.29 units daily and gave 15.7 kg. of milk ; group *C* were given 11-72 forage units daily and produced 16.3 kg of milk. The three groups gave respectively about 150, 169 and 138 kg. milk per 100 forage units.

The milk yield of group *C* was not raised by an increase in the forage units and the increase in live weight was but slightly greater than that of group *A*.

Series C. Time of reduction of forage units. — This experiment was undertaken with a view to determining whether the milk yield of cows was perceptibly influenced by feeding too liberal a ration, viz. by giving them the same forage units when their milk yield was decreasing as when they were in full milk. All the groups were put on normal rations (*A*) from the beginning of the experiments. In the case of groups *A*, the variations only affected the forage unit and were carried out on the basis of the milk yield during the preceding period of one fortnight. In the case of groups *B*, a change was only made in ⅓ of the forage units and at intervals of one week. No difference was made in the rations of *C* and C_1 until the milk supply fell to the amount given by normal groups with a reduction of two forage units, and then only one forage unit was reduced, so that in any case, the animals received one forage unit more than was warranted by the milk yield of the preceding fornight. In the case of groups C_2 the rations were maintained at their original level until the decrease in milk production justified a reduction of three forage units, and then only 1 forage unit less was given. The experiment was conducted on two farms, and lasted respectively 154, and 140 days. On an average

throughout all the experiment, and in the case of both the farms, 9.63 forage units were fed to group *A*, 9.46 to group *B* and 10.58 to groups *C*.

Per 100 forage units group *A* gave 135 kg. of milk
" " " " " *B* " 142 " " "
" " " " groups *C* " 128 " " "

From these results it may be concluded that there is no advantage in feeding an excess ration as compared with the normal from the time the milk flow begins to lessen.

Experiments in Feeding Babassu Cake and Coconut Cake.

Babassu, a new type of cake, and coconut cakes used in the experiment gave the following analyses:

Percentage Composition of Cakes.

	Cakes made from the *Babassu* (a Brasilian palmeacea)	Coconut Cakes
	%	%
Crude protein	21.94	23.31
Net protein	21.44	22.44
Crude fat	7.33	6.89
N-free extracts	42.48	42.93
Fibre (WEENDE method)	12.03	12.55
Ash	5.38	6.04
Water	10.54	8.28

It was at first supposed on the basis of similar experiments that the forage value of both kinds of cake would be the same and 0.9 kg. was reckoned per forage unit.

Only one experiment with three groups of cows was made. Group *A* (the normal lot) were fed concentrates composed of a mixture of six different kinds of cake of which 5 % was coconut cake. Group *A* received 0.115 kg. babassu cake (in the concentrated forage mixture) per kg. of milk and per day, while the relation of 1 forage unit containing 150 gm. of net digestible protein remained unaltered.

Group *C* was treated in a similar manner except that 0.110 kg. coconut cake was fed per kg. of milk. A summary of the data of this experiment is given in table II.

All the groups gave the same amount of milk throughout the preliminary period (during which all the cows received the same ration), but groups *B* and *C* gave less milk than the normal group during the experimental period. The fat content of the milk given by groups *B* and *C* during this time increased, however, considerably, while that of the milk yielded by *A* was only slightly higher. Thus, the best results for fat production per cow and per day were obtained from groups *B* and *C*. Throughout the post-experiment period when all the groups again received the same forage ration, the milk yield once more became almost the same,

TABLE II. — *Daily Yield per Cow.*

	Milk	Fat	
	kg.	p. 100	gm.
A. *Normal group:*			
1. Preparation period	17.3	3.33	575
2. Experiment »	16.1	3.38	543
3. Post-experiment »	15.5	3.76	583
2. Months 1	— 1.6	+ 0.05	— 32
3. Months 1	— 1.8	+ 0.43	+ 8
B. *Group fed babassu cake:*			
1. Preparation period	17.2	3.39	582
2. Experiment »	15.6	3.88	603
3. Post-experiment »	15.5	3.80	585
2. Months 1	+ 1.6	— 0.49	+ 21
3. Months 1	+ 1.7	+ 0.41	+ 3
C. *Group fed coconut cake:*			
1. Preparation period	17.3	3.21	556
2. Experiment »	15.5	3.62	562
3. Post-experiment »	15.3	3.67	562
2. Months 1	+ 1.8	+ 0.41	+ 6
3. Months 1	+ 2.0	+ 0.46	+ 6

but the fat content of the milk in the case of group *A* was nearer that of the milk of both *B* and *C* than during the experiment period.

Although only a single experiment was made, there is no doubt that, under certain conditions, babassu cakes and coconut cakes increase the fat content of milk.

Further, the experiment would seem to show that the food value of babassu cakes and of coconut cakes fed to dairy cows is about the same

III. *Testing the Daily Milk Yield of each Cow.* — At the request of the Research Laboratory, experiments for determining the milk and butter-fat yield of 15 cows, were conducted at the " Tune " Agricultural School from November 1, 1921, to October 31, 1922. The milk of each cow was weighed and the butter-fat percentage found.

The chief object of these extensive tests was to determine as accurately as possible the yield of a cow by means of periodic weighings and analyses. The results obtained by a provisional inspection of the large mass of material gave the following results:

1) Milking has a very perceptible influence on milk yield.

2) The daily variations in the milk and butter yield are very considerable, even in cows that receive the same food and treatment.

3) The fat content gradually diminishes at the beginning of the lactation period, then remains fairly stationary till the end of that period, when it rises to a high percentage.

4) Tests made at intervals of 10, 14 or 21 days give a figure for the total yield that is sufficiently accurate for all practical purposes.

5) The calculations made by the Local Testing Society were about 5 per cent. higher than the actual yield as found by daily investigations.

Correspondent for Denmark.

977. Condensed and Powdered Buttermilk for Dairy Calves.

ECKLES, C. H. and GULLICKSON T. W. (Division of Dairy Husbandry, University of Minnesota, St Paul, Minnesota) *Journal of Dairy Science*, Vol VII, No 3, pp 213-221, tables 3, graphs 2, figs. 2, bibliography. Baltimore, 1924.

The experiments of the authors were undertaken in order to ascertain whether it is possible to insure normal growth in calves by substituting condensed, or powdered, buttermilk for skim-milk. In the first experiment, there were two lots; the first of these was composed of a pure-bred male Jersey calf and a half-bred Guernsey heifer both of which were fed condensed, or powdered, buttermilk up to the age of 105 days. The second group consisted of 2 half-bred Guernsey heifers and one pure-bred Jersey bull-calf weaned when 150 days old.

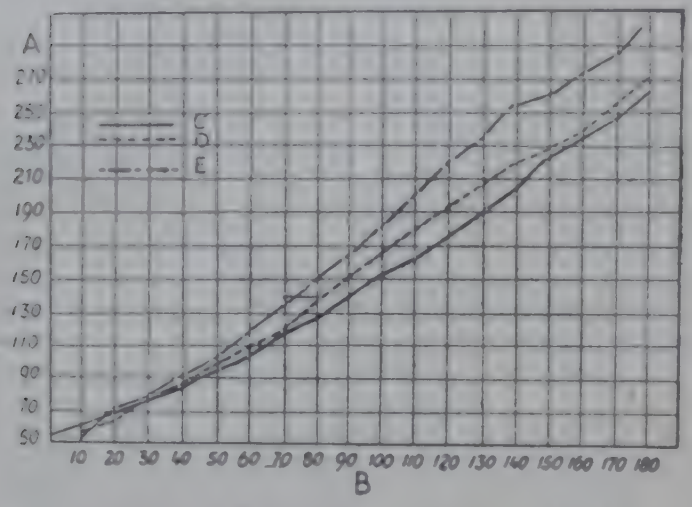


FIG. 153. — Growth of calves raised on semi-solid and powdered butter milk rations compared with normal growth.

A = Weight in pounds; B = days of age; C = normal weight; D = semi-solid butter milk to 105 days; E = powdered buttermilk milk 150 days.

In the second experiment, 5 half-bred Holstein calves were given powdered buttermilk up to the age of 70 days and two others were fed on the same food until 150 days. old.

Comparison between condensed and powdered buttermilk.

	Fresh buttermilk	Condensed buttermilk	Powdered buttermilk
	lb.	lb.	lb.
Total solids	9.4	30.51	92.11
Water	90.6	69.49	7.00
Protein	3.6	11.14	35.00
Fa	0.1	0.84	2.86
N-free extracts	5.0	15.80	43.59
Ash	0.7	2.73	11.46
Calcium		0.449	2.73

The buttermilk was derived from cream neutralised before churning by the addition of calcium salts. Before being fed to the calves the butter-

milk was mixed with sufficient hot water to give it the average composition of fresh buttermilk.

The calves were fed whole milk for 10-15 days and the buttermilk was substituted gradually as a supplementary ration; the calves received lucerne hay *ad. lib.* and a concentrate composed of maize flour + wheat bran + linseed cake (4 : 1 : 1).

The increase in weight was ascertained every 10 days and the increase in height every 30 days.

The two following graphs (Figs. 153 and 154) show the growth curves of the animals used in the experiment, compared with the curves of normal growth.

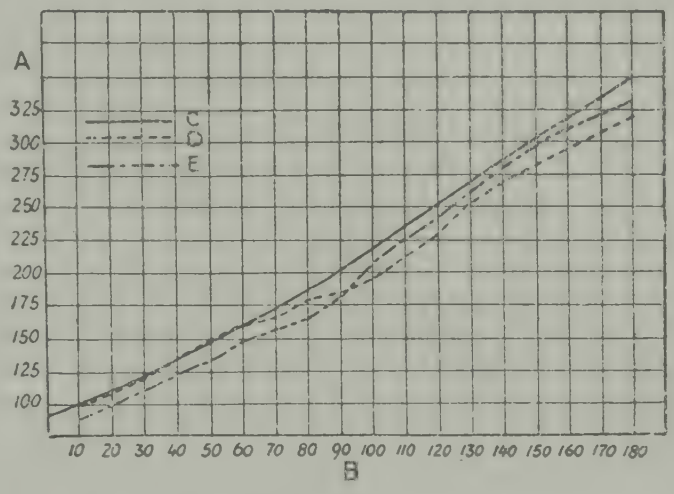


FIG. 154. — Growth of calves raised on powdered butter milk compared with normal growth.
A = Weight in pounds; B = days of age; C = normal weight; D = powdered buttermilk to 70 days; E = powdered buttermilk to 150 days.

It may be concluded that, as a general rule, calves reared on butter milk grow in a very satisfactory manner; this was especially noticeable in the Jersey-Guernsey lot weaned at 150 days. The calves weaned at 70 days lost ground a little and were not able to make the loss good until they reached the age of 6 months. The difference in weight was, however, not enough to justify economically a longer period of butter milk feeding.

During the experiments, the calves were free from all diseases and digestive troubles. They seemed to prefer buttermilk to whole milk. No diarrhoea supervened although a little more faecal matter was expelled than when the calves received whole milk, but this increased rather than diminished the vigour and vitality of the animals. The calves had glossy coats, looked well and were as large and healthy as the other calves on the farm that had been reared in the usual manner. P. D.

978. **The Selection of Cattle and the Proportion of the Three Classes of Meat in Net Meat** (1).

LAPLAUD, M. and DEGOYS, F. De la sélection des bovins et de la proportion des trois catégories de viande dans la viande nette. *La Revue de zootechnie, revue des éleveurs*, Year 3, No. 7, pp. 11-12, tables 2. Paris, 1924.

A. *The proportion of the three classes of meat in net meat.*

The meat of a butcher's beast differs in value according to the part of the animal from which it comes. These differences are due to the com-

(1) See *R.* 1924, No. 681. (*Ed.*)

position of the various cuts which may consist of compact muscular fibres, or of fibres intermixed with tendons or aponeuroses, there being a variable proportion of meat and bone present as well as of intramuscular fat. The meat of the hinder-parts is justly valued higher than that of the fore-parts and has been proved by analysis to be more nutritious.

Therefore, from the trade-standpoint, the meat of an animal is divided into three classes composed as follows :

First class : thigh, sirloin, ribs ;

Second class : Shoulder-blade, shoulder, under-sirloin ;

Third class : breast, collar, damaged meat.

The authors obtained in the course of their weighings in 1920 almost the same average percentage weights for all 3 classes in 4 groups of cattle. Thus the percentages of the first-class were as follows : —

Work-oxen 45.2 ; young bulls 45.98 ; Normandy cows 45.2 ; Mancel cows 45.8.

These results were confirmed by another experiment made on 100 cattle of different breeds and ages. The net meat of 18 of the animals being cut up into small pieces, and weighed separately in order to find the weight of each of the pieces, while the net meat of the rest was only separated into the three classes.

Effect of yield. — The instances given below show that the net meat yield has little effect upon the proportion of the classes of meat.

1 lot of Normandy cows yielding						51	%	first class	44.4
1 » » » » »						54	%	» »	44.2
1 young Charolais bull »						52	%	» »	48.0
1 » » » »						61.5	%	» »	48.5
1 » » » »						56.1	%	» »	48.2
1 » » » »						57.4	%	» »	53.1

The yield depends upon the degree of fattening ; to the credit of the first class can only be placed the external fat and the intramuscular fat which cannot affect the net weight to the extent of perceptibly altering the percentage.

Influence of sex.

Lot of Charolais heifers	47	%	of first class
Lot of Charolais young bulls	46.8	%	» » »
Normandy heifers	44.2	%	» » »
Young Normandy bulls	45.5	%	» » »

Sex exercises a slight effect in favour of the males, but it cannot produce great differences.

Influence of age.

Young Charolais (males)	46.9	%	of first class
Rejected Charolais (males)	44.8	%	» » »
Young Normandy bulls	44.8	%	» » »
Old Normandy cows	44.3	%	» » »

The proportion of first class meat is less in old animals than in young, this is due to growth phenomena ; as the animals grow older, the pieces of the second and third classes of meat increase more in weight in proportion to the pieces of the first class.

Influence of breed.

Young Normandy bulls	44.8 %	of first	class
» Limousin »	46.1 %	»	»
» Charolais »	46.9 %	»	»
Old Normandy cows	43 %	»	»
Old Normandy bulls	44.3 %	»	»
Bozadais bulls	44.1 %	»	»
Garonnais bulls	44.1 %	»	»

There is a slight advantage in the case of the cows of the two beef-breeds *par excellence*, the Limousin and Charolais, but the difference is so little that it may be concluded that the proportion of the classes only varies to a negligible extent and that breed has a minimum effect upon its variations.

B. *Average weight of various joints of meat.*

The average of the joints was obtained from 18 oxen ; the average of the classes from 75 animals.

The thigh accounted for 21 % of the total net weight ; the sirloin for 17 % and the ribs for 7.5 %. The first class meat represents 45 % of the total net weight. An average of 25 % of the net weight is represented by the second class : the shoulder-blade furnishing 14 %, the under sirloin 4.3 %, the shoulder 5.5 % ; the sirloin 1.7 % and the under-sirloin 0.6 %. The third class represents 27 % of the net weight : breast 12 % ; collar 2 % ; low-grade meat 7 %. The rest of the 100 % is made up by the kidneys and kidney fat that may be placed with the third class. An examination of the author's tables shows that, in the case of most of the animals, their deviation from the average was very slight. Out of 87 nimals, 39 deviated only 1 % from their group average as regards the arst class of meat ; the deviation of 26 was over 2 % and that of 13 over fi %.

The general average was 45.19 % ; 56 animals deviated less than 2 % from this average and 12 animals deviated less than 3 %. Therefore the average percentages represent a general rule to which most of the animals conform. Hence, we may consider that this study taken in its entirety proves the existence of unvarying harmonious proportions between the different parts of an animal. The weights of the meat classes are functions of one another. The proportion of meat of the first, second and third classes is constant in relation to the net meat total. In order to realise the ideal of a butchers' beast viz., one that forms a paralleliped, the fore-quarters must not be less well developed than the hind-quarters. Further, the best ox should yield the same proportion of third-class meat as the most ordinary cow. Therefore, the total proportion of net meat does not

effect the ratio of the classes. The object of selection should not be the increase in cuts of the first class (which it is not probable can be attained), but early maturity, aptitude for assimilation and for fattening, and a good conformation which leads to an improvement in the appearance, texture, tenderness and flavour of the meat, as well as to a larger meat yield. The total yield of net meat is pratically the most important factor.

P. D.

979. **Relation of Milk Production to the Twinning Tendency.**

HUNT A. G. (Department of Dairy Husbandry, University of Nebraska, Lincoln, Nebraska). *Journal of Dairy Science*, Vol. VII, No. 3, pp. 262-267. Baltimore, 1924.

Since great prolificness has been observed to be closely connected with high milk yield, the author set himself the task of ascertaining whether any relation exists between milk production and twin-bearing.

For this purpose he used a lot of 357 cows taken at random which had produced twins and were registered in the Holstein-Friesian Herdbook. 165 of the animals were the dams of male, or male and female twins, while 192 had borne only female twins. The records of the Advanced Official Register of the 357 cows were examined with the object of solving the following question. Do the dams of twins give more milk than cows producing a single calf? It should be remarked that the fact of one lot yielding more milk than the other might be due to a larger number of the animals having satisfied the requirements of the A. O. R. rather than to the higher average milk production of the cows on the register.

Percentage of resistered cows (the dams of male twin calves) satisfying requirements.	55.7
Percentage of registered cows (dams of female twin calves) satisfying requirements	45.8
Percentage of all the registered cows that satisfied requirements. . . .	29.4

These figures show that a cow which is the mother of twins is twice as likely as an ordinary cow to satisfy requirements of the O. A. R.

If it is remembered that 2 to 12 % of the registered cows have not produced living offspring, and the highest figure is therefore taken, the above percentages thus corrected would be 32.4 (29.4 + 12) in the case of all the cows admitted to the O. A. R., and 55.7 and 45.8 in that of the mothers of twins.

The author discusses these figures and quotes in support of his theory the pedigrees of very prolific cows, and draws the following conclusions:

1) There is a direct relation between great prolificness and high milk yield, just as there is between partial sterility and low milk production.

2) This relation is also proved when the factor of prolificness is demonstrated by the production of twins.

P. D.

980. **Birth-Weight and Gestation in Dairy Animals.**

FITCH, J. B., GILLARD, P. C. and DRUMM, G. M. (Kansas State Agricultural College, Manhattan, Kansas). *Journal of Dairy Science*, Vol. VII, No. 3, pp. 222-233, tables 6, bibliography. Baltimore, 1924.

The author first summarises the data obtained from previous work on the subject and then gives the results of his study of the calves produced by the dairy cows of the herd belonging to the Kansas State Agricultural College between September 1, 1910 and January 1, 1922. The calves and their dams were weighed 6 hours after calving. In order to avoid all errors, no calves born after gestation periods of less than 260 days, or of more than 295 days, were taken into account; twin calves and calves dropped by cows whose weight had not be recorded were also excluded from the calculations.

The principal results of this study were as follows:

Average Weight of Calves at Birth.

Jersey:	25.85	kg.,	or	6.3	%	of the	weight	of the dam.
Guernseys:	29.02	»	»	6.7	»	»	»	»
Ayrshires:	32.65	»	»	6.9	»	»	»	»
Holsteins:	41.28	»	»	7.8	»	»	»	»

Bull-calves weigh from 1181 to 4.98 kg. more than cow-calves. The average birth-weight of all the male calves is 7.8 % higher than that of the females.

The weight of the calves dropped by the cows of the different breeds rose up to the 5th calving and subsequently fell, according to the age of the cow, after the 6th calving.

The birth-weights recorded for the calves of the Kansas Agricultural College are considerably higher than those obtained at Iowa and Missouri.

The rations given to the dam have little effect on the calves weight except in the case of cows kept on a limited diet, when the calves are heavier in proportion than those produced by liberally fed cows.

Birth-weight is an individual character, although it can be influenced to a limited extent by the sire.

The length of the gestation period has no precise effect upon the weight of the calves at birth; but when the gestation period is longer, the calves are generally heavier.

The average duration of gestation was 282.4 days, the male calves being carried 283.2 days and the females 281.9 days. The average gestation periods of the various breeds were as follows:

Jerseys: 284.3 ± 0.72 days; Guernseys: 283.0 ± 0.46; Ayrshires: 284 6 ± 0.44; Holsteins: 281.0 ± 0.15.

P. D.

981. **Lake Tchad Cattle.**

PECAUD, G. (Chef de Service de l'élevage de la colonie du Tchad) Les bœufs du lac Tchad. *Revue d'histoire naturelle appliquée*, Part 1, Vol. V, No. 4, pp. 97-107; No. 5, pp. 141-146, figs. 3. Paris, 1924.

The author gives a detailed geographical and ethnographical study of the region where the so-called Lake Tchad race of cattle is bred. This area includes not only the Archipelago of Lake Tchad, but also all the district of Kanem properly so-called which is an easterly prolongation of the lake zone. The total number of adult cattle belonging to the Colony of Tchad may be estimated at about one million of which some 180 000 head are of the Lake breed.

The Lake Tchad ox is known by the name of "Boeuf Kouri", or "Bœuf Behré", and belongs to the species of *Bos taurus*, having no hump on the withers. Its average height ranges from 1.30 m. to 1.50 m., and has an average weight of 480-450 kg. The head is long (56-65 cm. from tip of nose to nape of neck) and is surmounted by a large hairless mass of which the upper ridge is depressed in the form of a V. The horns are very characteristic: normally, they are round in section, 70 to 120 cm. long, and fairly thick (circumference at base 20-30 cm.), light coloured with black tips. They either rise in a high vertical lyre, or cross one another, leaving a wide space between them; the tip is often curved backwards and the whole horn seems to have been twisted so that the exterior is turned inwards, and the front backwards. Such horns are chiefly found in the case of the cattle of the mainland, the horns of the island animals are remarkable in shape and present curious anomalies (such as "cornes en bouées", or buoy-shaped horns). These horns are inserted rather high, at a distance from the frontal bone, the bony base is at first narrow, the horn expands and becomes of enormous size (50 cm. to 1 m. round the base), sometimes attaining a length of 1.50 m., while the tips are very wide apart. Many other anomalies are also to be found: very short horns with the keratogenous pad thrown back over the base of the horn for the distance of about a hand's breadth; flat, wrinkled horns, different degrees of "floating" horns; complete hornlessness, in which case the bony excrescence ("*chignon*") assumes a characteristic "sugar-loaf" shape. The forehead is broad and flat if the horns are in the same plane as the head, but it is convex if the horns are directed backward. The neck is short and flat, there being scarcely any dewlap. The chest is narrow, the flank is long, the withers are sunk, the back wide, straight or slightly sloping, croup somewhat sloping, short, wide and pointed; buttock low, the tail, which is inserted between the two points, is long and has a heavy switch. The limbs are strong and bony, hocks thick, hoofs large, heavy, very open. The udder is round and well-developed. The coat has a white, or very light dun ground more or less marked with red, black, or fawn.

These animals are heavy and lymphatic in temperament owing to the damp hot climate of the lake district where they are bred. They run very much to fat, therefore, if properly managed would make excellent butcher's beasts. The cows are good milkers according to the standard

of the country and give 6-8 litres aday of milk from which 30 to 35 gm. of butter per litre can be made. The bulls are used as pack animals ; a single bull can easily carry 120 kg. and travel at the rate of 4 km. an hour. In the islands, the bull are castrated and fattened for the butcher.

The ideas of cattle-breeding are very primitive ; the herds live in the open without any shelter and graze the natural pastures. Milk is used by the natives as an article of food, any surplus being made into butter to be bartered on the markets. Stock-owners never part with sterile cows, or young bulls, unless compelled by necessity. The only meat eaten is mutton and goats' flesh. Castration is effected by crushing, or drawing out, and cutting the seminal cord. This operation is carried out when the animals are 6 months old and it is seldom that any bad results occur. Breeding takes place haphazard on the grazing grounds, no care is taken of cows in calf, and the calves are dropped among the thickets and brushwood. The calves are insufficiently fed ; sometimes they are allowed to suck two of their dam's teats during the morning and evening milkings. When one month old, the calf runs with the other young animals of its own age, and when 6 months old follows the herd. The herds of cattle graze from early morning under the supervision of young children ; at night they are picketted on cultivated land, in order to manure the soil. The animals are made fast by the fore-legs, either singly or in pairs. They are watered morning and midday throughout most of the year, but are given water three times aday during the great heat. The herds move on as the pastures become exhausted ; the cattle being good swimmers, cross the arms of the lake without difficulty

The breeders are indifferent as regards outbreaks of epizootic disease and never think of isolating the animals, or giving them any proper medicinal treatment.

The chief epizootic cattle diseases of this region are : rinderpest, peripneumonia (treated by vaccination), foot-and-mouth disease (common but of a benign form), and an ill-defined piroplasmosis. Tuberculosis is unknown, as is also trypanosomiasis except in pack oxen that visit the region of Fort Lany.

Nigeria is the principal market for cattle reared in the Tchad district. The animals are sent by road, or across the lake. Each canton of Kanom has a weekly cattle market.

Tchad is the only colony of its group where stock-breeding is of sufficient importance to warrant this industry being protected, in the interest of the region itself and in order to insure the meat supply of the neighbouring peoples. R. D.

982. **The Introduction and Breeding of the Buffalo in the State of Minas Geraes, Brazil.**

Criação de bufalo em Minas. *Chacaras e Quintaes*, Vol. 29, No. 5, p. 457, fig. 1. São Paulo, 1924.

Señor A. Muchado, a stock-breeder of the State of Minas Geraes, introduced into that country a number of buffalo from British India.

The animals soon became acclimatised and the females produce one calf annually, as well as yielding a fair amount of milk with a large percentage of fat. The young buffaloes grow rapidly and are easily tamed.

The buffaloes in the island of Marajo are said to be wild; they are hunted for industrial purposes. F. D.

983. The "Gromet" Sheep.

WRIEDT, CRH. (Department of Agriculture, Ski, Norway). The "Gromet" Pattern in Sheep, Another Mendelian Character in Live Stock. *The Journal of Heredity*, Vol. XV, No. 3, pp. 124-126, figs. 2. Baltimore, Md. and Washington D. C., 1924.

In the Western part of Norway, a sheep is often found with light-grey spotted head, a black patch above the eyes, on its nose, and around the lips. Very frequently, the black colour also extends to the cheeks. The ears are black, edged with grey; the legs are entirely black, except for a grey stripe on the front of the fore-legs and on the side of the hock. sometimes a black stripe is present on the neck and the chest. This scheme of coat colour is known by the name of "Gromet".

In several flocks, the author found lambs of this type which were the offspring of white parents. One sheep-breeder in Norway tried to obtain a pure race of Gromet animals by using 2 rams with the required characters.

Ram No. 1 × Gromet ewe = 3 Gromet lambs.

Ram No. 2 mated with 8 Gromet ewes produced 20 Gromet lambs.

The two rams and most of the ewes were the progeny of white parents. Subsequently, ram No. 1 was mated with 2 white Cheviot ewes with the result that 2 white lambs were born; when this ram was mated with 2 black-faced ewes, 2 black lambs without Gromet markings were produced.

Two Gromet lambs were, however, obtained by mating the same ram with 2 Gromet ewes whose dams had been of the Gromet type. When ram No. 1 was mated with a black ewe, the latter dropped one grey lamb with the Gromet markings.

On mating ram No. 2 with 2 Cheviot ewes, two white lambs were obtained. The lamb resulting from mating a Gromet ewe with a white Cheviot ram was also white.

Another breeder obtained one Gromet lamb and one white lamb from mating a Gromet ewe and a white ram. The lamb born from the union of the same ram and a white ewe was black with Gromet markings.

A black-faced ram × Gromet ewe = black-faced lambs without Gromet markings.

The following table shows the results obtained.

Matings	Progeny: Gromet	Progeny: Non-Gromet
Gromet × Heterozygous animal	3	1
Gromet × Gromet	23	0
Gromet × Non-Gromet	0	9

The frequent occurrence of Gromet animals in white flocks shows that this coat-colour depends upon a simple Mendelian factor which is recessive as regards white and is also recessive in the presence of the factor producing black-faced lambs. P. D.

984. The Comparative Food Value of Barley, Maize, Carobs and Crushed Sorghum for Feeding Sheep.

BOUCLEY, Ch. and HUSSON (Professors at l'Institut agricole de Maison-Carrée). Etude sur la valeur alimentaire comparée de l'orge, du maïs, des caroubes et du sorgho concassé dans l'alimentation des moutons à la bergerie. *Revue agricole de l'Afrique du Nord*, Year 22, No. 255, pp. 394-400. Algiers, 1924.

The authors give the results of experiments repeated in the Stockbreeding Laboratory of the Agricultural Institute of Algeria with a view to determining : 1) the comparative food value of barley, maize, carobs and sorghum for feeding sheep on the farm ; 2) the most profitable ration from the standpoint of growth increase ; 3) the optimum duration of the fattening period 4) the effect of temperature on the duration of the fattening period ; 5) the organoleptic properties of the mutton according to the food given.

The fattening experiment was carried out on 16 castrated sheep of Arab breed of the average age of 15 months. The animals were in good health and weighed on an average 28.900 kg.

The 16 sheep were divided into 4 lots each fed a ration of different composition. The fattening period varied from 54 to 89 days ; one group of sheep was slaughtered after 54 days, the second at the end of 76 days, the third after 82 days and the fourth after 89 days. In order that the results obtained should be comparable, each group of sheep slaughtered was composed of one animal taken from each of the lots that were being fattened.

The animal were weighed fasting at the beginning of the experiment and also at the same hours, and fasting, on the 30th, 53rd, 59th, 75th, 82nd and 89th day.

Their food consisted of : forage (vetches an oats) carobs, maize, barley and crushed sorghum. The ration were fed thrice daily and at regular hours viz. at 7 and 11 in the morning and at 6 in the evening. The sheep were provided with water *ad lib.*

Average temperature of sheep-farm.

November	+ 12.5° C
December	+ 9.4° C
January.	+ 11.4°

The cost price of the ration and of kg. of live-weight increase given in the following table is the maximum, for all the food was bought in the market. It is for sheep breeders themselves to ascertain whether, under their special conditions, it is worth while attempting to fatten their sheep.

Table of the composition of the rations fed from October 20 to November 20.

Lot I	Lot II	Lot III	Lot IV
Dry forage . . 1.200 kg.	Dry forage . . 1.200 kg.	Dry forage . . 1.200 kg.	Dry forage . . 1.200 kg.
Crushed barley. 0.600 »	Crushed carobs 0.600 »	Crushed maize. 0.600 »	Crushed maize. 0.600 »
Cost of ration . 0.50 fr.	Cost of ration. 0.37 fr.	Cost of ration. 0.61 fr.	Cost of ration . 0.61 fr.
Crude elements. 1048 »	Crude elements 1029 »	Crude elements 1071 »	Crude elements 1018 »
Digestible elements . . . . 810 »	Digestible elements . . . 703.2 »	Digestible elements. . . . 738 »	Digestible elements. . . . 675 »
Nutritive ratio . 1 : 7.7	Nutritive ratio. 1 : 9.3	Nutritive ratio 1 : 8	Nutr t.ve ratio 1 : 7.1

From September 21 to the end of the Experiment.

Lot I	Lot II	Lot III	Lot IV
Dry forage . . 1.200 kg.	Dry forage . . 1.200 kg.	Dry forage . . 1.200 kg.	Dry forage . . 1.200 kg.
Crushed barley. 0.700 »	Crushed carobs 0.700 »	Crushed maize. 0.700 »	Crushed sorgum 0.700 »
Cost of ration . 0.53 fr.	Cost of ration. 0.45 fr.	Cost of ration. 0.08 fr.	Cost of ration . 0.68 fr.
Crude elements. 1126.4	Crude elements 1105	Crude elements 1154	Crude elements 1098
Digestible elements 883	Digestible elements . . . 773	Digestible elements . . . 813	Digestible elements. . . . 745
Nutritive ratio . 1 : 8.5	Nutritive ratio. 1 : 9.9	Nutritive ratio. 1 : 8.2	Nutritive ratio 1 : 7.5

Increase in live-weight and cost of 1 kg. increased live-weight.

	Lot I	Lot II	Lot III	Lot IV
Average initial weight	27.25 kg.	25.25 kg.	25.25 kg.	25 kg.
Average daily gain.	0,158 »	0.1745 »	0 196 »	0.180 »
Average cost of ration	0.52 fr.	0.43 fr.	0.64 fr.	0.64 fr.
Average cost of kg. increased live-weight .	3.27 »	2.41 »	3.29 »	3.64 »

Quality of meal and melting-point of kidney-fat.

No. of lots	Quality of meat	Average melting point of kidney fat
I) Barley . .	First quality; kidneys almost entirely covered white firm whites fat	45.5° C.
II) Carrobs .	Dark-red meat; kidneys incompletely covered; fat pink.	45.°2 C.
III) Maize . .	First quality; kidneys entirely covered; firm white fat .	44.6° C.
IV) Sorghum .	First quality; kidneys completely covered; fat fairly firm; white	45.0° C.

The conclusions drawn from this experiment are that the greatest profit is obtained from carobs, then barley, maize and sorghum in descending order.

Barley, maize and sorghum produce meat of very good quality, but carobs impart a darker colour to the meat.

As regards the distribution of the internal fat, the kidneys are completely covered when maize, sorghum and barley are fed and incompletely covered when carobs are given.

The average daily increase with these foods was as follows : maize 196 gm. ; sorghum 180 gm. ; carobs 174.5 gm. ; barley 158 gm. ;

P.D.

985. The Bayeux Breed of Swine.

HÉDIARD, L. (Ingénieur agronome, Directeur des Services agricoles de Calvados). Le porc de Bayeux. *Journal d'Agriculture pratique*, Year 88, Vol. II, No. 36, pp. 192-194. Paris, 1924.

The Bayeux pig is characterised by having a white coat spotted with black, in which point it resembles the English breed of Gloucester Old Spots. The black markings vary considerably is size and position ; the white is always predominant, and the extent of the pigmented areas seems to increase with the age of the animal.

Distinctly black patches where both skin and hair are coloured, are much preferred (in the case of young pigs) to slate-coloured patches due to the skin alone being coloured.

The Bayeux pig has a rather long side, semi-drooping ears, and a long cylindrical body. It is a hardy, thrifty animal, easily accustoms itself to changes of diet. The sows are prolific and make good mothers ; none with less than 12 teats are kept for breeding. The average number of piglings in a litter is 9-10, but farrows of 12 are frequent.

The Bayeux pig fattens easily and produces a large proportion of meat with thin layers of fat.

The breed was created as follows : Normandy-Berkshire, or Berkshire-Normandy, crosses were made ; sometimes a little Yorkshire blood being introduced, and the hybrids thus obtained were crossed together, all throw-backs to the original types being eliminated. It is possible that there was some introduction of Tonkin pigs of the Asiatic breed which have black, or black and white coats.

The Bayeux breed is now well fixed as regards its characters, general conformation and quality. The piglings are weaned at 6 weeks ; when two months old they are given a liberal diet of skim-milk, grain, meal and cooked roots. They never leave the sty.

The sucking-pigs are sold to farmers who feed them for 4 months, when they pass into the hands of the dealers supplying the cheese-manufacturers with pigs for fattening.

While at the cheese-factory, the pigs are given whey and barley-meal, the latter being sometimes replaced by palm-oil cake, or peanut cake, manioc flour, or rice offals.

Four months are required to fatten the pigs satisfactorily ; they are then sold by the cheese manufacturers at the age of 8 months, when they weigh 100-120 kg. If the greasy waste waters are given to the pigs, they attain a weight of 200-250 kg.

Fattened pigs of the Bayeux breed are used in the Normandy pork-butchers' trade, and large consignments are sent to supply Paris and other large towns.

The Bayeux breed has been recognised by the French Syndicate of pig breeds and a standard is being drawn up for it. P. D.

980. Observations on Caserta, Yorkshire and Poland China Pigs as Profitable Feeders.

GIULIANI, R. Osservazioni su la capacità di utilizzazione dei mangimi nei suini Casertani, Yorkshire, e Poland China. *Rivista di zootecnia*, Year 1, No. 7, pp. 201-205, diagram 1. Portici, 1924.

Among the numerous factors to be taken into account in judging a breed of pigs the most important is its capacity of turning food to good account, since the economic function of the pig is to transform the most different kinds of food into meat and fat. The author experimented in this direction using for the purpose, individuals of the Caserta Yorkshire and Poland China breeds. The experiment was begun on April 24 with 2 Caserta and 10 Yorkshire pigs ; on June 4, a couple of Poland Chinas were added. Each pair of pigs was kept in a separate sty, but given the same food. At first, the ration fed each pair of pigs was as follows : shorts 1 kg. ; crushed maize 0.800 kg. ; meat-meal 0.200 kg. ; bone-meal 0.100, lucerne or green clover, 1 kg. After 40 days, no more meat meal, or green forage, were given. The ration was then composed of shorts, mill sweepings and 100 gm. bone-meal. Subsequently, the ration was again altered by the introduction of acorns and peanut cake. From the quantitative standpoint, the ration was fixed every 10 day at the time of weighing, the increase in live-weight and the appetite of the pigs being taken into consideration. The whole experiment lasted 157 days in the case of the Casertas and Yorkshires and 116 days in that of the Poland-Chinas.

Experimental results obtained.

	Caserta breed	Yorkshires	Poland-China breed
Increase in live-weight	121 kg.	105 kg.	72 kg.
Concentrates eaten	504.1 kg.	504.1 kg.	252.9 kg.
Amount of concentrates consumed per 100 kg. increase in live-weight	416 kg.	480 kg.	350 kg.
Starch value of concentrates consumed (units)	285.53	285.53	142.65
Starch units per 100 kg. increase in live-weight	235.78	271	199
Cost in *lire* per kg. of increase in live-weight	2.80	3.27	2.45

Thus, the greatest daily increase in live-weight (0.385 kg.), was made by the Caserta pigs, the Yorkshires only gaining 0.334 and the Poland-China pigs 0.310 kg.

On examining the figures given in the table, it will be seen that the Poland-Chinas proved the best and most profitable feeders.

The number of pigs used in the experiment was not large enough to make it possible to arrive at any definitive conclusions, but the results would seem to show that the Caserta pig if well selected can hold its own with the best breeds of swine as regards its capacity of turning food to the best account. P. D.

987. Comparative Value of Centrifuged Milk and Whey in Pig-Feeding.

BADOUX, F. (Directeur de la Station laitière et l'école cantonale de fromagerie de Moudon) Valeur comparée du lait centrifugé et du petit-lait dans l'alimentation des porcs. *Annales agricolesv vaudoises*, Year 2, pp. 59-65, tables. Lausanne 1924.

These experiments were organised on the following bases :

32 pigs 5 months of age were distributed among 4 sties each containing 8 pigs fed in the same way. The experiment lasted 95 days. All the animals in 2 of the sties were given 5 litres of whey each, while the pigs in the other sties were fed 5 litres of centrifuged milk. The other foods were combined in such a manner that the animals of both lots were fed the same number of kg (within a few gms.) of dry food. The ingredients of each ration were weighed every day.

The rations were gradually changed according to the appetite of the pigs, and their increase in weight. The following results per head and per day were obtained by feeding these various rations for a fortnight at a time.

Average daily increase in live weight per pig.

Dates	Whey lot	centrifuged milk lot
From January 20 to February 3.	629.4 gm.	794.0 gm.
» February 4 to February 17	580.4 »	675.9 »
» February 18 to March 3.	879.5 »	803.5 »
» March 4 to March 17.	437.5 »	451.0 »
» March 18 to March 30	598.2 «	623.8 »
» March 31 to April 14.	509.0 »	633.5 »
» April 15 to April 25	323.9 »	272.7 »
Average during experiment . . .	573 gm.	602 gm.

Per series of one fortnight and per 1 kg. of starch unit in the ration, the following increases in live-weight were obtained per head and per day,

Daily increases per kg. of starch unit.

Date	Whey lot	Centrifuged milk lot
From January 20 to February 3	376.0 gm.	464.5 gm.
» February 4 to February 17	339.5 »	327.0 »
» February 17 to March 30	487.0 »	434.5 »
» March 4 to March 17	235.5 »	237.5 »
» March 18 to March 30	314.0 »	322.0 »
» March 31 to April 14	262.0 »	320.0 »
» April 15 to April 25	167.0 »	138.0 »
Average during experiment	314.0 gm.	328.0 gm.

The average increase during the whole experiment was 54.433 kg. in the case of the whey lot, and 57.200 kg. in that of the centrifuged milk lot.

On taking the different prices paid per pig and estimating the average prices of the concentrates for the year, the following figures are obtained respecting the utilisation of whey and centrifuged milk. The general expenses are, however, not taken into account.

Sale price of pig, 2.4 fr. per kg.

Actual utilisation of the whey . . . . . 2.56 cent. per litre
Actual utilisation of the centrifuged milk. . . . . 4.58 » » »

Sale price of pig. 2.2 fr. per kg.

Actual utilisation of whey. . . . . 2.20 cent. per litre
Actual utilisation of centrifuged milk. . . . . 4.01 » » »

Sale priee of pig 2. fr. per kg.

Actual utilisation of whey . . . . . 1.83 cent. per litre
Acteal utilisation oi centriluged milk . . . . . 3.44 » » »

P. D.

088. **Comparative Experiments in Pig-Rearing in Denmark.**

Lund, A. V., Beck, N. and Rosting, P. Resultater fra sammenlignende Forsøg med Svin fra statsunderstøttede Avlscentre. 114*de Beretning fra Forsøgslaboratoriet*, udgivet af den Kgl. Veterinaer og Landbohøjskoles Laboratorium for Landøkonomiske Forsøg, No. 114, pp. 1-132. Copenhagen, 1923.

The pigs kept in Denmark belong with few exceptions to two breeds, the native Danish breed and the Large White Yorkshire. The native Danish pigs, which are also white, greatly outnumber the Yorkshires, the latter being only used for industrial crosses.

Nearly 40 years ago, Denmark began exporting bacon to England, being driven to seek a new market for this product owing to the change in

the German Customs regulations which put obstacles in the way of sending pork and bacon into Germany. A very different type of pig is in demand in England from that which finds favour in Germany. In the latter country, large fat swine are preferred, whereas on the English market, the best sellers are pigs of average size with plenty of flesh but not too much fat. The efforts of the Danish breeders have therefore been directed to rearing pigs of this type. It would have been possible to solve the difficulty by importing a considerable number of Large White Yorkshires from England, but it was feared that a loss would be entailed by introducing these animals on an extensive scale, as they are little adapted to withstand the rougher conditions of life in Denmark. The method adopted was that recommended by the Stock-Breeding Adviser to the State, MØRKEBERG. It is still in use and has proved eminently successful in increasing pig-breeding among Danish agriculturists.

Breeding Centres for the native pig were established in districts where the type of pig kept, best satisfied the requirements of the English market and where the small pig-breeders personally supervised their own stock. These centres were placed under the supervision of the breeders who were most capable of directing the breeding operations and received a small annual State grant on the condition of submitting to the control of Commissions appointed to demonstrate and select the best breeding-animals in the respective centres, to ascertain that the necessary operations are carried out satisfactorily, and that the animals are marked, etc.

In addition to these Breed-Centres for the Native Danish Pig, *Breed-Centres for Yorkshire Pigs* were also founded, by the purchase of Large Whites from England. The object of these latter centres was to obtain a first-class butcher's animal by mating English boars with Danish sows. Since each boar can serve many sows, a limited number of Yorkshire breed-centres was sufficient, more especially as the pigs sold were chiefly young boars. It was hoped that in time it would be possible to improve the-native breed so that the Yorkshire could be entirely dispensed with. At the beginning, only a few Centres were founded, but their number has been gradually increased. When the last report was published, there were 151 Native pig Centres and 32 Yorkshire pig Centres, containing respectively, 216 boars and 1056 sows, and 47 boars and 211 sows. Between the foundation of the first Centres in 1898 and August 31, 1922, the Centres sold the following number of breeding-animals.

	Boars	Sows
Native breed	228 35	578 46
Yorkshires	87 25	36 13

The Centres are subjected annually (by districts) to an inspection and the best centres head the list which is published every year. An important element in the decision is the Report furnished by the Experiment Station as regards the development and pork qualities of the swine. In order to throw further light on these matters, the three Experiment Stations of *Bregentved*, *Elsesminde* and *Over Løjstrup* have been created in

their several provinces, the work of fattening the swine and judging the carcases devolves upon the Experiment Laboratory. Each Centre is required to forward to the Experiment Station of its province a certain number of young pigs farrowed by sows appointed by the Director. The piglings are sent at the age of 6 to 8 weeks and must all belong to the same litter (each batch is composed of 2 castrated males and 2 females) and be healthy animals of similar size. The piglings are lodged and fed at the Station, where they receive only ground maize, skim milk and water. The piglings are given barley until they weigh 35 kg., after which the ration consists of equal parts of maize and of barley. The ration is converted into forage units (one forage unit being, 1 kg. barley, 1 kg. maize and 6 kg. skim milk). As soon as the fattening process is complete, the number of forage units consumed to produce 1 kg. of increase in live weight is calculated and the figure obtained shows the amount of growth. When the pigs weigh about 90 kg., they are killed and the carcases are inspected and measured, to determine their quality. A scale of points is employed: 15 = excellent, 12 = very good, 9 = good, etc.

The chief results obtained in 1923 are summarised in Table I.

TABLE I. – *Report of the Development and Meat Quality of the Swine Fed at the Three Experiment Stations from September* 1, 1922 *to September* 1, 1923.

	Native breed			Yorkshire breed		
	Bregentved	Elsesminde	Over-Løjstrup	Bregentved	Elsesminde	Over Løjstrup
Number of groups	76	10	96	10	37	27
Age in days:						
at beginning of experiment	62	57	57	54	59	65
at end of experiment	190	183	198	198	184	205
Weight in kg.:						
at beginning of experiment	17.1	15.4	16.0	12.4	15.7	16.8
at end of experiment.	91.6	91.2	93.1	91.8	89.4	92.3
Kg. forage units consumed for 1 kg. increase in weight throughout the experiment	3.46	3.74	3.79	3.35	3.69	3.68
Percentage of offal waste	27.6	26.7	26.4	26.5	25.4	24.9
» » offal	12.6	13.1	12.7	12.7	13.3	12.7
» » exported pork	60.0	60.2	60.9	60.8	61.3	62.4
Thickness of fat (in cm.) on back	4.1	4.4	4.2	3.6	4.2	3.8
(Measured before, in middle behind) on abdomen	2.6	3.3	3.0	2.6	3.4	3.1
Length of body (in cm.) from the cotyloid cavity to the articulation of the nape of neck	87.8	80.4	90.8	87.4	88.3	90.7
Points 15-0 for:						
firmness of meat	12.3	11.8	12.7	12.4	13.3	13.9
shoulder region	12.0	11.6	11.9	12.0	12.1	12.0
thickness and distribution of fat on back	12.3	11.8	12.6	12.4	12.3	13.0
Shape and fatness of abdomen	11.3	11.2	12.2	11.5	12.2	12.8
Shape and size of hams	12.0	11.8	12.0	12.4	12.5	12.5
Quality of head feet and skin	12.3	11.8	12.3	12.6	12.8	12.6

It may be seen from Table I that the development of the two breeds is very similar, although there is a slight difference in favour of the Yorkshires. The latter breed supplies most of the pork for export and generally obtains most points for conformation. The body length of both breeds appears to be equal. The pigs from the Bregentved district developed most (lowest forage consumption) ; this fact was also observed during the last three years.

In the report dealing with Bregentved, a table is given (on the basis of the averages of 40 groups), showing the average weights of the native breed at different ages. These data are incorporated in Table II

TABLE II.

	Groups consuming small amounts of forage	Groups consuming average amounts of forage	Groups consuming large amounts of forage
Number of groups	19	20	10
Age at beginning (in days)	172	191	219
Kg. of forage units consumed per 1 kg. increase in live-weight	3.18	3.47	393
Average weight of each individual:			
At age of 2 months	19.4	16.3	14.8
» » » 3 »	35.0	28.3	22.4
» » » 4 »	53.9	41.8	35.9
» » » 5 »	77.4	63.0	51.8
» » » 6 »	—	84.4	68.1
» » » 7 »	—	—	80.6
Percentage of exported pork	61.4	60.8	59.6
Marks (15-10) given for:			
Firmness of meat	12.2	12.2	12.3
Thickness and distribution of fat on back	12.8	12.2	12.2
Thickness and amount of fat on abdomen	11.5	11.5	11.3
Size of hams and amount of fat	12.3	12.0	11.8
Quality of head, feet and skin	12.3	12.1	12.1

The groups consuming little forage are the heaviest from the beginning and always maintain their superiority in this respect being ready for the butcher 47 days (over 1 ½ months) earlier than the group consuming a " large " amount of forage. It must, however, be borne in mind that the consumption here termed " large " is far below the habitual consumption of pigs kept by farmers. The percentage of exported pork shown in Table II is in inverse proportion to the forage eaten : the largest amount of pork for export was obtained with the least consumption of food. In this respect, there is little difference as regards the conformation points, but there is nothing to be said in favour of low consumption.

In conclusion, it should be remarked that since the autumn of 1923, a synoptic table has been published every three months, giving the results obtained for the three groups whose fattening was terminated during this time at the respective Experiment Stations.

(Correspondent for Denmark.)

Poultry :

989. **Variability in Weight of Leghorn Chickens at Different Ages.** —

LATIMER, H. B. (University of Nebraska). The Variability in Weight of Leghorn Chickens at Hatching, Thirty-five Days and Maturity *The American Naturalist*, Vol. LVIII, No. 656, pp. 278-281, tables 2 New York, 1924.

A study of the variability of the weight of chicks at different ages and of the correlation between their weights at different periods of growth The author used for his experiments White Leghorn chicks with single comb. The birds belonged to the Avicultural Section of the University of Nebraska ; they had been hatched in an incubator and artificially reared. The eggs were hatched at different dates from February 12 to May 11, 1922. The chickens were easily identified by a mark affixed first to the wing and later to the leg.

The number of chicks hatched was 510 males and 542 females ; after 35 days, the weights of 414 males and of 379 females were noted. The age at which the first egg was laid was determined by the use of trap-nests in the case of 263 pullets, and 239 of these birds were weighed before being set at liberty.

The results of the 1994 weighings are given in the table.

The maximum variability was observed at the age of 35 days ; the variability was less at the time of sexual maturity and minimum at hatching. The variability coefficient in the case of females 35 days old is 2.69 times larger then the coefficient of variability at hatching, while at the time of laying the first egg, the coefficient of variability is 1.46 times larger than at the time of hatching. At sexual maturity and at hatching, the amount of growth and the variability in weight are both less than at the age of 35 days when development is very rapid and variable. When the chicks are just hatched, the variablity coefficient is 1.097 times greater in the case of females than in that of males, but when the birds are 35 days old, the coefficient of variation is 1.05 times larger in the males than in the females.

Coefficient of Correlation.

1) Weight at hatching and at age of 35 days (males) + 0.02202 ± ± 0.0259.

2) Weight at hatching and at age of 35 days (females) + 0.1042 ± ± 0.0344.

3) Weight at age of 35 days and at sexual maturity (males) + + 0.0061 ± 0.0436.

4) Weight at age of 35 days and at sexual maturity (females) — — 0.02672 ± 0.0407.

The three first correlation coefficients are too small to be of any significance ; it may be concluded that a male, or a female, chick which is heaviest at hatching is not likely to be heaviest when 35 days old ; in the same way, no correlation practically exists between the weights at the age

of 35 days and at sexual maturity respectively. There is, however, a negative correlation between the weight of the chicks at the age of 35 days and at the time of sexual maturity; this would appear to show that a pullet which is heavy when 35 days old will begin to lay earlier than the average date. Here again, however, the correlation coefficient is very small, therefore it must be concluded that the data at disposal do not warrant our taking the weight of the bird at the age of 35 days as a basis from which to predict the weight it may attain at sexual maturity, or the age at which it will begin to lay.

Variability in Weight of White Leghorn Chicks at Different Ages.

	Weight at hatching		Weight at age of 35 days		Weight of females at maturity	Age (days) of mature pullets
	Males (510)	Females (452)	Males (414)	Females (379)	Females (239)	Females (263)
Averages	39.45 ± 0.09	39.16 ± 0.10	209.15 ± 1.60	191.71 ± 1.45	1626.5 ± 3.38	209.81 ± 1.09
Deviations	32–50	30–48	66–351	83–297	1140–2268	153–303
Type deviation	2.91 ± 0.06	3.07 ± 0.07	48.39 ± 1.13	41.76 ± 1.02	192.14 ± 5.93	36.27 ± 0.77
Coefficient of variability	7.37 ± 0.16	8.09 ± 1.18	23.14 ± 0.54	21,78 ± 0.56	11.81 ± 5.97	12.52 ± 0.78

P. D.

690. **Poultry-Feeding Experiment, State Research Farm Werribee.**

RUGG C. W. (Chief Poultry Expert) and PEDERIK, O. W. (Poultry Foreman) *The Journal of Agriculture of Victoria*, Vol. XXII, No. 7, pp. 420-424, tables, Victoria, 1924.

This paper gives the results of an experiment recently carried out to determine how far it is advisable to give White Leghorns varied foods *ad-lib*, instead of the two following rations:

a) Dry paste in hopper always at the disposal of the birds, chopped green food at midday and a scratch feed of grain in the evening.

b) moist past in the morning, chopped greens midday and a scratch feed of grain in the evening.

The experiment lasted 51 weeks; 108 White Leghorns divided into 3 lots of 26 birds were used. All possible precautions were taken that the lots should be as similar as possible as regards age, size, quality and egg-laying capacity.

Lot No 1. Free choice of foods: bran, wheat shorts, oats, barley, rape-cake, wheat, Algerian oats, crushed maize and barley. These foods were placed in separate hoppers and protected from rodents and birds. Unchopped, freshly-cut green food was always placed at the disposal of the fowls.

Lot 2. Dry paste: bran, wheat shorts, 10 lb. meat meal, 3 lb. of powdered charcoal and 5 lb. of rape cake were added for every 100 lb, of flour. This paste was always at the disposal of the birds, which were given in ad-

dition, chopped green food at midday and grain (wheat, oats, crushed maize and barley) as a scratch-feed in the evening.

Lot No. 3. Moist paste : bran, wheat shorts and green food mixed. The birds had free access to this paste and they received, in addition, chopped green food at noon and grain (wheat, Algerian oats, crushed maize and barley) as a scratch-feed in the evening.

Once a week, the fowls were given finely chopped onions ; ground oyster-shells and charcoal were always at their disposal.

After describing the manner in which the fowls were housed, the author gives different tables showing the food consumption of each lot, the cost of feeding, the number of eggs produced and their value, together with the average profit realised from the different lots.

The following conclusions may be drawn from these tables :

White Leghorns are able to balance their own rations and to produce eggs economically. Although the average number of eggs laid by each bird of lot I was below 7 and the food cost comparatively more than that of lot 3, the saving of labour in feeding largely compensated for the inferiority of lot I.

The results of the experiments also entirely contradict the prejudice felt by some breeders against using Algerian oats as a poultry food. The oats given were only of average quality, but they were eaten by the hens in preference to barley or maize.

The amount of maize consumed varied according to the season, the largest quantity being eaten in July which was the hottest and dampest month.

Rape cake was eaten with avidity by the fowls when mixed with the dry paste.

It was also found that the hens of lot I ate more green food than the birds of the other two lots and that they consumed it just before going to roost. It was then decided to give green food to the fowls after their grain meal ; this new departure was followed by a large increase in the number of eggs produced.

P. D.

991. **Effect of Meteorological Conditions on Egg-Laying.**

LAPLAUD, M. and GARNIER, A. Influence des circonstances météorologiques sur la ponte. *Revue de zootechnie, revue des éleveurs* Years 3, No. 8, pp. 93-110. Paris 1924.

The author takes as the source of his information the carefully registered results of the second and third National Egg-Laying Competitions of Vaulx-de-Cernay. The meteorological data were collected at the same time by the Meteorological Station of the Competition and by another Meteorological Station of the domain of Vauls-de-Cernay.

The average temperature fell little below 0°C ; the rainfall was abundant (840 mm. in 1922 ; 106 rainy days). Prevailing winds, west in winter, south-east in summer. Warm wind, south sector ; cold wind, north sector. The soil was healthy, allowing the water to drain away rapidly ; owing however to its sterile character, the vegetation was sparse, being

composed of lichens, broom, birches and pines. A certain number of the runs were on grass ; 25 of the birds were put in runs of 500 m². In the centre, there was a Canadian fowl-house 10 m² with glazed front and built to face south-east ; shade and wind-shelters were provided in each run.

The hens were fed with the view to encourage intensive egg-laying, therefore, liberal rations were given twice aday. In the morning, the hens received a mixture of grain (oats, buckwheat, millet, etc.) and early in the afternoon, a hot paste was fed. The individual effect of the greater, or less, susceptibility of one breed to either cold, or heat, was eliminated by the fact that a very large number of breeds were entered for the competition and the authors considered the results obtained from all the lots together. In the same manner, on account of the large number of birds, the periods during which egg-production ceased may be supposed never to have coincided in the case of all the hens, so that the daily output of eggs did not fall as a result of these periods.

In order to obtain the required data, the authors traced the following curves on the same sheet of paper:

1) Curve of variations in barometric pressure ; 2) average temperatures ; 3) wind speed ; 4) rainfall ; 5) number of eggs laid daily during the whole competition ; 6) variations in daily laying of the 4 lots placed in the first class.

The analytic study of the egg-laying shows an important factor, viz, the influence of the season. It is seen that few eggs are laid in winter, and that the winter-layers belong to the same lots, so that winter egg-production is a question of age and of physiological maturity.

Results obtained in the seasonal study. — In winter, few eggs are laid and the output of eggs depends upon a limited number of birds whose high egg-laying capacity renders them insensible to variations of temperature.

Very great changes of the barometer frequently correspond to sudden rises and falls in the egg-curve. Egg-production is distinctly decreased by the first cold, though a series of days with low temperature has little effect, but abrupt changes from day to day are marked by the variation curve. Hens readily adapt themselves to any given temperature, but they cannot stand changes in the temperature.

Wind without rain has little effect, unless the temperature changes suddenly ; if the rain is warm, the wind promotes egg-production, but if the wind is accompanied by a cold rain, the effect is most injurious. Windless rain only influences egg-laying in so far as it reacts upon the temperature.

In spring, egg-production increases in spite of great daily variations in the thermometer. The egg-production curve often follows barometric pressure for a short time. Very high, or very low, pressure often decreases egg-laying, the effect showing itself on the day, or the evening of the maximum or minimum pressure.

Egg-laying is not arrested by a low temperature that falls progressively. The first warm days are favourable, but the first hot windless days reduce the number of eggs.

A hot, or warm wind unaccompanied by rain is favourable to egg laying, and a warm wind coupled with rain regularly increases the output of eggs which is however checked by a cold wind accompanied by rain.

In summer, egg-production is high at the beginning, but flags during the intense heat, and rises again in the autumn. All extremes of barometric pressure have a bad effect upon laying hens. Temperatures varying between 10°C and 15°C. seem the best. Great heat and sudden cooling off of the atmosphere both cause a fall in egg-laying. Winds in summer, even if they are stormy, have little effect. Rain, whether violent or not, is injurious on the day of its fall, but improves egg-laying during the following 2 or 3 days. Continuous rain for 2 or 3 days decreases the number of eggs, which however rises when the weather is fine again.

As regards the autumn, the time when the egg-laying competition finished, no exact data exist.

Study of effects of natural phenomena. — I. *Barometric pressure.* Effect undeniable, but not clear. The birds dislike extremes of pressure and prefer average pressure.

II. *Temperature.* Average temperatures are the most favourable. The best climate is that of which the seasonal variations are progressive, but not abrupt. Severe cold appears less injurious than great heat.

III. *Wind and rain.* These must be studied together and in connection with the temperature. The effect of wind seems to be due to its altering the temperature, for the isolated action of wind is not defined.

Wind accompanied by warm rain appears beneficial; cold wind and cold rain are injurious. Summer rain is favourable, except on the day it falls.

It may be concluded that there is no simple coordination between the phenomena studied. A distinction must be drawn between simultaneousness and correlation. When hens are physiologically in a condition to lay eggs, they are not deterred by cold, while if they are not ready for laying, their failing in egg-production is not to be attributed to low temperatures.

P. D.

Sericulture.

992. **Silk Production in the British Empire.**

LEFROY, H. MAXWELL (Professor of Entomology, Imperial College of Science and Technology, London). *Bulletin of the Imperial Institute*, Vol. XXII. nº 2, pp. 152-172, tables 3. London, 1924.

The silk used in the spinning and weaving factories in England is almost entirely produced in countries outside the Empire; in 1922, out of 976 000 lb., only 78 000 was from Empire sources. The author considers that in some countries, India and Cyprus for instance, there is the possibility of great improvement in quality and immense increase in output.

The article supplies data and information respecting the producing countries, viz., India, Cyprus, and other areas such as Australia, Hong

Kong, Federated Malay States, Ceylon, Mesopotamia, Sudan, Kenya, Uganda, Rhodesia, West Indies and British Honduras.

A description is given of the essential features of mulberry silk production and reference is made to Eri silk ; the Eri silkworm feeds on the castor plant and spins a cocoon that cannot be reeled, but which is used in silk spinning.

In an appendix, statistics are given of the production of raw silk and cocoons, and the importation of silk raw materials into the United Kingdom.

W. S. G.

FARM ENGINEERING.

Methods of Cultivation.

993. **When is Water Safe for Irrigation Purposes.**

PARKINS, A. J. (Director of Agriculture), *Bulletin No.* 176, pp. 12, Department of Agriculture South Australia. Adelaide, 1924.

The author alludes to the apparent contradiction of views held by different authorities as to the safety of irrigation waters, and draws attention to the fundamental importance of drainage. Waters which might be quite safe in some soils would be injurious in others. The chief factor is probably the subsoil and its tendency to give good or bad drainage

Under Adelaide conditions, with winter and spring rains of 14 to 15 inches, irrigation water may contain up to 140 grains per gallon of injurious salts ($NaCl$, $MgCl_2$, $CaCl_2$, Na_2SO_4, $MgSO_4$) for fruit trees and vegetables, if the drainage is good. Under similar conditions citrus trees and beans may be grown with 75-80 grains per gallon of injurious salts to the gallon.

Irrigation waters of a relatively high saline content may be used in summer with greater safety where winter rains are heavy, than in localities where they are light.

Irrigation water highly charged with saline matter should be used freely rather than sparsely. Small quantities of water lead to rapid concentration of salts under the influence of surface evaporation, whereas abundance of water tends to retain soil moisture at the requisite degree of dilution.

W. S. G.

994. **The Use of the Carbon Dioxide of Springs for the Stimulation of Plant Growth.**

VOIGTMANN. Nutzung Kohlensäurehaltiger Quelle zur Förderung der Pflanzenwachtums. *Die Technik in der Landwirtschaft*, Year 5, No. 2, pp. 39-40. Berlin, 1924.

The author describes various means by which the water of springs rich in carbon dioxide can be used in agriculture. In the case of cold

springs the carbon dioxide can easily be liberated in green houses by making the water circulate in pipes provided with certain very simple mechanical catalysts which are described by the author. Hot springs can be utilised to warm the soil. R. D.

995 **Motor-Ploughing and Cattle-Breeding.**

PACI, C. Motoaratura e allevamento bovino. *Atti della R. Accademia dei Georgofili*, Year CLXXI, No. 2, pp. 82-114. Florence, 1924.

The author states that motor-ploughing far from being exclusively a question of agricultural mechanics, is primarily a complex problem of rural economy, for which reason he considers it entirely from the standpoints of agriculture, stockbreeding and social economy, and is of opinion that: 1) more attention should be paid in agricultural schools to instruction (especially practical instruction) in rural engineering and mechanics; 2) travelling agricultural schools, agricultural societies and agricultural institutes should organise and carry out motor-ploughing experiments, especially under difficult conditions; 3) the agricultural institutions should take steps to create societies for the common purchase and use of tractors and motor-ploughs in districts of average and medium-sized holdings. He further syggests that in districts such as the Podolian cattle-rearing regions, and especially in Tuscany and Umbria, where the celebrated Chianine beef-breed and its derivatives make meat production the most paying branch of farming, steps should be taken to increase the area of artificial pastures and consolidate and improve the organisation of stockbreeders with a view to improving the beef-qualities of the breeds at the expense of their traction power. A. C. M.

996 **The Improvement of Exhausted Soils, Experiments in Brazil.**

FREISE, F. W. Terras cançadas e sua regeneração *Revista da la Sociedade Rural Brasileira*, Year X, Nos. 49-50, pp. 224-227. São Paulo, 1924.

In Brazil, and especially in the State of São Paulo, there are many square kilometres of land which have been exhausted by coffee crops and are now abandoned, as they are only covered with a meagre crop of grass which grows with difficulty. In 1910, the author began the study of these soils and has examined 200 samples from the States of San Paolo, Minas, Rio and Spirito Santo. These samples were taken from two types of soil, viz., soils derived from the Archaean rocks and Red Soils. The article in question summarises the results obtained from the Archaean soils (gneiss).

All the samples analysed had a uniform composition. The difference between the exhausted and the fresh soils consisted in the much lower percentage of phosphoric acid, carbon dioxide, sulphuric acid and organic substances present in the former.

Under the climatic conditions of Brazil, where there is no frost to exercise its disintegrating power, nine-tenths of the components of gneiss remain insoluble throughout the life of a coffee-plantation, which is at the

longest 100 years. The coffee-trees threfore exhaust the reserve material, slowly accumulated by the virgin forest, of which they occupy the site.

The improvement of these worked-out soils would be a matter of centuries if it were left to nature. In order to remedy their condition quickly it is necessary to have recourse to the methods adopted by the United States, viz.: 1) Breaking up the land with explosives such as ammonium nitrate; 2) digging-in organic substances (waste products of the timber trade); 3) irrigating the soil with dilute solutions of fertilising salts. F. D.

997. **Crop Rotation under Irrigation.**

HOLDEN, J. A. *Bulletin* 190, pp. 11, tables 2. Scottsbluff Experiment Station, University of Nebraska, U. S. A., 1924.

The results obtained at Scottsbluff Station during the past eleven years on 35 different crop rotation systems make it evident that, on an irrigation farm, success or failure is largely determined by the cropping system followed by the farmer.

All the one-crop systems tested showed a loss, varying from $192 with maize to $3234 with potatoes. All rotations not having alfalfa showed a loss, except one 2 year rotation of oats and sugar beets, manured. Every rotation which included alfalfa showed a profit. The data was obtained from 6 years' experiments

Two of the most profitable rotations were:

(i) alfalafa, potatoes, oats, sugar beets (manured).

(ii) alfalfa, potatoes, sugar beets, sugar beets (manured), oats and alfalfa

The information contained in this Bulletin should make it possible for an irrigation farmer to plan a successful rotation. W. S. G.

Machines and Implements.

998. **A Preliminary Investigation into the Draft of the Plough.**

DAVIES, W. M. *Journal of Agricultural Science*, Vol. XIV, No. 3, pp. 370-406, figs. 15. London, 1924.

The object of the work was to discover the magnitude of the draft of a plough working under normal conditions and under varying conditions. For this purpose it was necessary to construct a self-recording dynamometer, a full description of which is given in the text.

Soil samples were always taken to ascertain the mechanical composition and the moisture content of the soil.

The conclusions reached are summarised as follows: The state of consolidation resulting from the nature and treatment of the previous crop has a marked effect on the draft.

The relation between draft and depth of furrow is linear, the net draft per square inch tending to increase in value with increasing depth,

except when the previous crop was roots, when a decrease at depths greater than 6-8 inches is noticeable

The relation between draft and width of furrow is linear.

The quantity of moisture in the soil has a considerable effect on draft. A decrease in soil moisture of 6 % resulted in an increase of draft of 28 %.

The double plough is a more efficient implement than the single plough, fittings and mould-board being similar in design. W. S. G.

999. **Implements fitted with the " Retro Force " Apparatus.**

BONYER, M. Les Instruments " Retro Force " *Bulletin de la Société des Agriculteurs de France*, Year LVI, No. 2, pp. 40-41. Paris, 1924.

" Retro Force " implements are distinguished by a new traction system that has many advantages.

Hand implements date back to remote antiquity and will always be used to a certain extent. Unfortunately, however, their output is small and labour is scarce and expensive.

Propelled implements. — These have recently been much improved by the addition of auxiliary machines.

Implements moved by traction. — Of these the most up-to date are ploughs drawn by a man whose power is applied to a cross-bar.

All these implements possess the common defect of requiring great manual exertion for their steering, with the result that the more muscular force required in traction, the less accurate is the steering

The " *retro force* " apparatus consists of a metal frame with two movable arms each provided with 6 screw-worms for the attachment of the implements. Two plough-handles 1.40 m. long and making an angle of 45° with the ground are affixed to the head of this frame. To one end of the frame is attached a traction-chain of suitable length, which is provided with a compensation spring, while the other is fixed (by means of a special clutch) to a clip placed above the front part of a wide belt which the worker wears round his body in such a manner as to transmit his force to the apparatus.

When the apparatus is brought above the soil and the chain fixed to the belt is drawn taut, the two plough-handles reach as high as the chest of the worker from which they are distant about 30 cm

As the handles are 20 cm. long, the plougher's hands grasp them comfortably.

The great advantage of this implement is, however, the method in which the traction is effected.

In order to put the machine in motion the worker bends himself slightly backwards; this change in his centre of gravity draws along the implement without the man having to exert any force by means of his arms. As the man walks backwards, he produces more, or less, traction force according to the amount he bends himself back.

This system of traction differs from any other because the two functions of traction and steering are wholly distinct. It should be noted, that

the arms are not involved in the traction, but remain quite free, so that the guiding of the implement is extremely easy. The depth of ploughing is regulated by a variable surcharge applied to the frame. The apparatus is very quickly mounted. All agricultural work except breaking up the land can be done satisfactorily with the " retro force ", while the average output of one man using it is equal to that of 8-10 men working with other implements. A. C. M.

1000. **New Type of Drill-Plough.**

Neuerung an Furchenziehern. *Landwirtschaftliche Maschinen und Geräte*, Year 24, Part 27, p. 205, fig. 1. Artern, 1924.

This drill-plough consist of a small accessory plough body (*m*) attached by its beam (*g*) to the beam of the principal body (*a*). The union of the two beams (*d*) makes the drill-plough able to move in the vertical plane ; lateral displacement is prevented by a guide-rod (*x*) fixed to the beam. This little accessory plough-body is placed behind, and on one side, of the principal body ; its position can be regulated vertically by a chain attached to the principal beam. R. D.

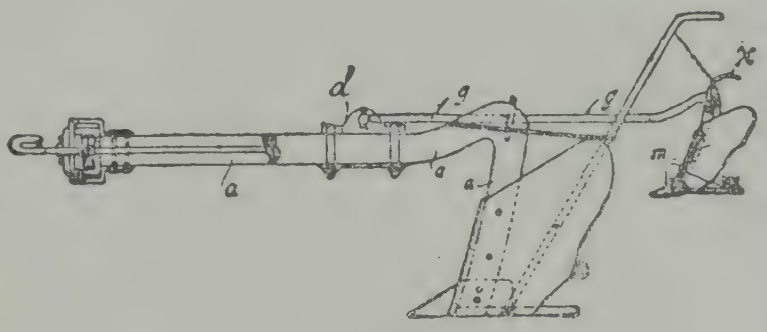


FIG. 155. — New type of drill plough.

1001. **An Arrangement for Régulating the Depth of a Drill in the Soil.**

BYEDRZYCKI S. Urvagi nad Koztaltem redlie siewnikowych. *Roczniki Nau Rolniczych*, Year XI, No. 1. pp. 36-43. Poznan, 1924.

From the agricultural point of view, the device for regulating the depth of a drill is a more important part of the implement than the distributor, for upon the construction of the said device depends, not only the covering of the seed, but the depth at which the latter is sown. The question requires studying, because the researches so far carried out have not furnished the maker with any information as to the required shape and size of the apparatus in question. Theoretically, apparatus of the European type press the soil and render it more compact, but further experiments are necessary to show to what extent a lateral or posterior position of the regulating apparatus affects the moulding up of the soil. A. C. M.

1002. **Disk Potato-Planter.**

Implements and Machinery at the Leicester Show of the Royal Agricultural Society. *The Implement and Machinery Review*, Vol. 50, No. 591, p. 415, fig. 1. London, 1924.

The potato-planter shown in the figure is characterised by the presence of two rotating disks, between which the potatoes fall and are then deposited at the bottom of the trench, in a perfectly straight line and at regular intervals, in consequence of which the subsequent cultivation and harvesting are rendered easier.

FIG. 156. — New disc potato-planter.

The machine plants the potatoes on the top of manure just as well as in a trench without manure, it presses down the manure into the bottom of the trench in such a manner that when the plough covers the potatoes, it also covers the manure. The machine was exhibited by Messrs WALLACE (Glasgow).

R. D.

1003. **Potato Planters and Lifters.**

SANTINI, C. *Le macchine per piantare e per scavare le patate*. Published by the Laboratorio di Meccanica e Costruzioni della R. Scuola Superiore di Agricoltura in Portici. (Taken from the *Annali della R. Scuola superiore di Agricoltura in Portici*, vol. XX, 1924). Portici, Stab. Tip. R. Della Torre, 1924.

The work under examination has a preface by Prof. G. D. MAYER on *Le macchine nella grande coltura della patate* (Machines for cultivating potatoes on a large scale) in which a short summary is given of the types recommended for executing different kinds of work from the preparation of the ground to the preservation and use of the potatoes when lifted.

Signor SANTINI, basing his remarks on the data collected by other authors and on the results obtained in machine tests conducted in the laboratory of the *R. Scuola Superiore di Agricoltura in Portici*, examines the following implements both from the mechanical and economic standpoints and also from the point of view of their adaptability to Italian agricultural conditions:

For planting: 1) RANSOM's three-row drill that can be regulated as

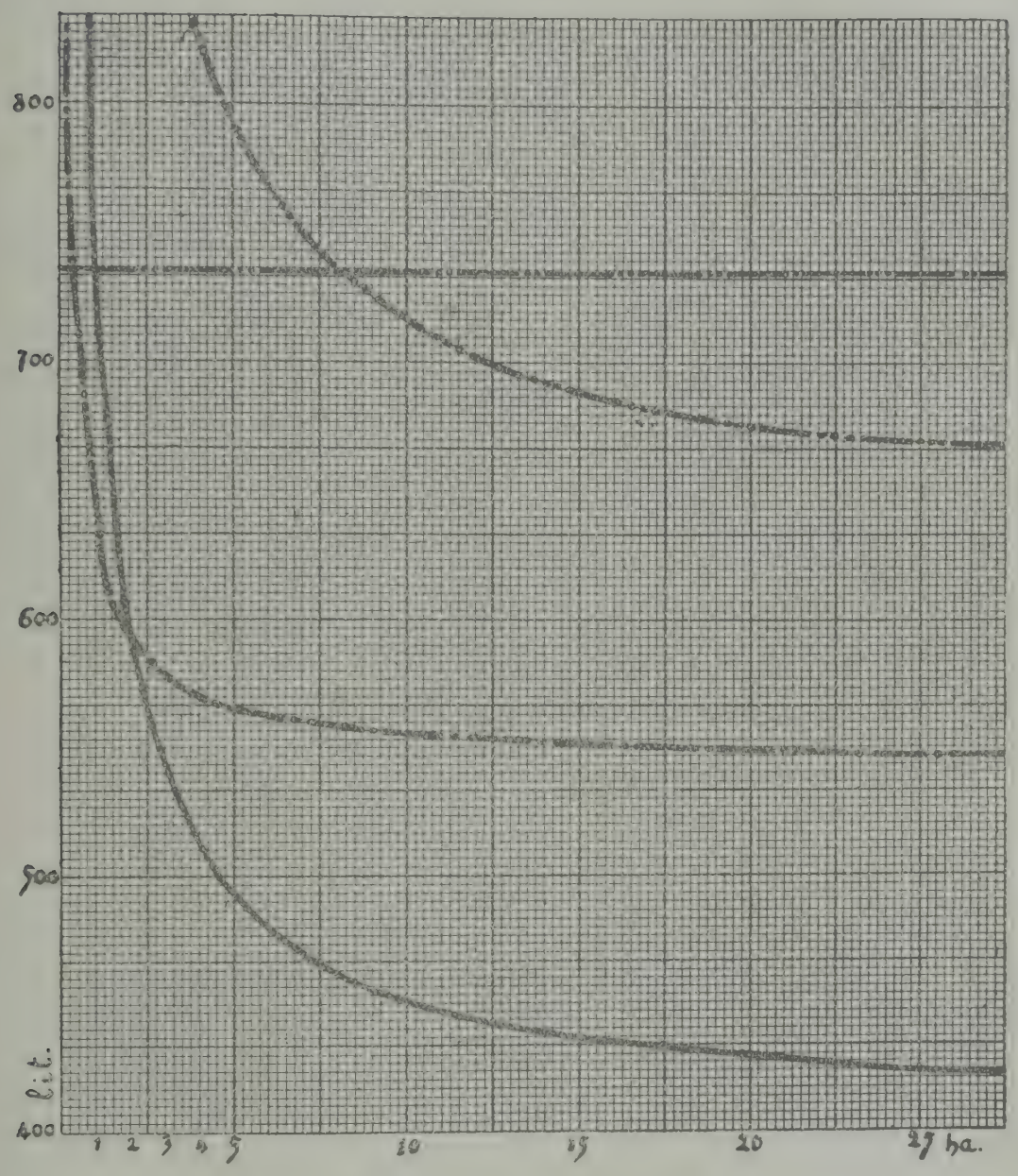


FIG. 157. — Cost of potato lifting.

——— .. ——— .. ——— Lifting by hand;
——— ... ——— ... ——— with special lifters (Hoover);
——— . ——— . ——— with rotary machine (Imperial);
——————————— with beet lifter.

The cost of hand lifting which is constant whatever be the area cultivated is represented by a horizontal line. The cost of lifting with the aid of mechanical implements depends upon the annual outgoing and therefore the times by which it is represented are curved. Any increase in the area under the crop (horizontal axis) diminished the cost of the harvest in liras per hectare (vertical axis).

regards the depth and distance of the furrows; 2) RANSOM's three-row planter, characterised by the rollers that press the soil lightly against the tubers; 3) UNTERILP's apparatus for drilling holes at uniform distances apart, 4) UNTERILP's disk covering apparatus; 5) REIM apparatus for making holes ("Pflanzlochmaschine" Reims-Reichenbacher Maschinenfabrik"); 6) OGLE Marker; 7) Champion potato-planter No. 25, Columbia Bajac, Erto, Plantector, Martin-Lesseria.

For harvesting potatoes: 1) potato-digger ploughs with conical grating; with double grating; South Bent Company's flat grating with hoe and star of spokes; Reha with perforated coulter: Rotating potato-diggers: *a*) simple with horizotal axes; Ransoms Caledonian Patent Rotary Potato-digger, new Ideal, made by Hermann Gueguer; Reima with elastic forks; Eyth; *b*) with vertical axes; Stoll potato-digger; *c*) with triangular levers: Harder and Westphalia potato-diggers; *d*) planet system "Stoll Model B", Hagedorn; 2) with articulated square; Randome's; 3) Potato-digger with lifters (Imperial, Star), 4) Hangs Potato-digger and bagger.

The implements are illustrated by 39 figures, and in addition, are given: the mechanical peculiarities of each; test results; various suggestions referring especially to the different factor affecting the quality of the work and to economical methods of work.

The study deals only with machines for planting and lifting potatoes, which are of chief importance from the standpoint of labour as weeding, hilling up, spraying, etc., can all be done with the ordinary farming implements.

The economic data resulting from the author's experiments prove that the percentage of tubers left in the ground is the factor that chiefly affects the total cost of the crop which is respectively for ploughs, rotatory types, implements with lifter 2.54 - 0.46 - 0.42 times the cost of working; 1.55 - 1.88 - 2.20 times the daily cost of harvesting; 2.00 - 1.58 - 2.00 times the expense of the necessary, though injurious, successive hoeings. The importance of this factor increases with the value of the potatoes.

How far it is advisable to employ machines as opposed to hand-labour and in relation to the areas in question is shown by the diagram. (Fig. 157).

For areas of less than one hectare, hand-digging is best; for fields 1-3 hectares in extent, ploughs with rotatory apparatus are equally good, but when the area under potatoes is larger, the above type of plough is a necessity. Machines with lifters are only cheaper than hand-digging for areas of more than 8 hectares.

F. D.

1004. Potato Sorter.

WEISS, E. (Ingénieur des Arts et Manufactures). Trieur de pomme de terre, *Recherches et Inventions*, No. 19, pp. 642, fig. 1. Paris, 1924.

M. NIQUET-HESEQUE has invented a new hand-worked potato-sorter for the small scale potato grower. The apparatus consists of two rect-

FIG. 159. — Pedigree Cattle House.

FIG. 161. — Cranked cart axle for sloping ground.

angular frames, loosely placed one above the other, so that the space between the shorter sides forms an opening for the discharge of the tubers.

Beneath the lower frame is a sheet-iron funnel for sorting out the small tubers which pass through the meshes; the upper frame has a network with larger meshes.

The apparatus is shaken 4 or 5 times and then the sorting begins; the larger potatoes are separated by the upper spout and the average-sized tubers by the side spout, while the small ones pass through the sheetiron funnel. R. D.

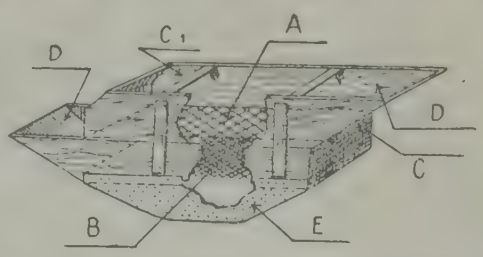


FIG. 158. — Niquet-Hésèque Potato Sorter.

1005. **Modern Cow-House Equipment.**

The Implement and Machinery Review, Vol. 50, No. 591, p. 340, figs. 3. London, 1924.

At the British Friesian Cattle Show at the British Empire Exhibition, special attention has been paid to cleanliness in the handling of milk. The cows instead of being chained are held by a kind of yoke, as shown by figure 159; this saves from 1 to 1 ½ feet of space. The dung of the animals falls into a channel. The floor of the cow-house is made of non-absorbent cork, which is warm, durable and odourless and far superior to cement. The food-racks are made of cement with double divisions in series to make cleaning easier. Each cow has a separate drinking trough and when the animal presses upon it with its muzzle, a current of clean tepid water is caused to flow. Special carriers of litter and food economise labour and assist in insuring cleanliness. Sliding doors complete the equipment of this ideal cow-house. R. D.

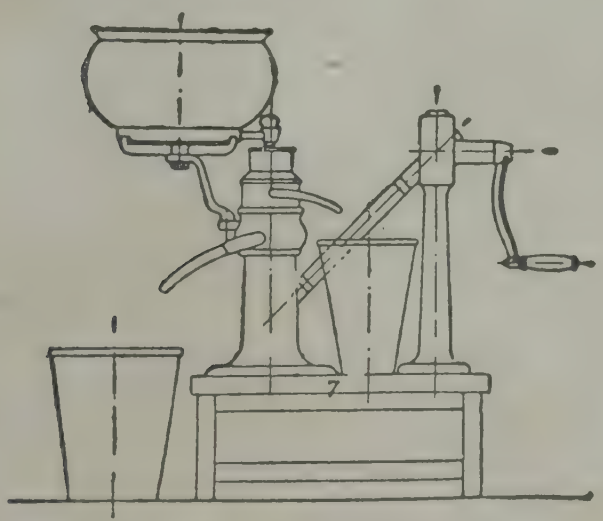


FIG. 160. — New driving gear for separator.

1006. **New Driving-Gear for Separator.**

Antrieb von Milchschleudern. *Landwirtschaftliche Maschinen und Geräte*, Year 24, Part 27, p. 205, fig. 1 Artern, 1924.

The figure (No. 160) shows a new type of driving-gear for cream-separators, the mechanism consisting of two spiral gearings connected by a slanting axis. R. D.

1007. **Pumping from Wells for Irrigation.**

EWING, F. A. *Bulletin* No. 1404, pp. 27, figs. 4, tables 3. U. S. Department of Agriculture. Washington, D. C. 1924.

The object of this Bulletin is to assist those interested in pumping from wells for irrigation, by making available the most essential information on well construction, and the selection, installation and working of pumping plants, as such knowledge is not usually possessed by the farmer.

Water supply, types of pumps, wells and cost of installation are discussed. W. S. G.

1008. **Irrigating Maize with the Aid of Tractors.**

HAVENHILL, Mark. (Extension Engineer Kansas Agricultural College). *Farm Implement News, the Tractor and Truck Review*, Vol. 45, No. 24, p. 19, figs. 4. Chicago, 1924.

In Kansas (U. S.), many agriculturists living in the valleys obtain a cheap irrigation plant by using their tractors for pumping. When this irrigation is carried out at exactly the right time, the maize crops can be doubled, with satisfactory results from the economic standpoint.

R. D.

1009. **Cranked Cart-Axle for Sloping Ground.**

MARRE, E. Essieu de charrette coudé pour terrain en pente. *La Machinique Rurale*, Year 8, No. 6, p. 135, fig. 1. Paris, 1924.

M. ROQUES (Frejeville, France) has devised an axle for carts working on steep slopes which allows of the cart turning without upsetting, no matter how much the ground may slope. The cart-axle is cranked at both ends. The knees are placed at right angles and inversely to one another. As one ascends, the other descends. This axle turns beneath the cart and a spiral gearing rests upon it. The gearing is worked by an endless screw prolonged by an iron rod connected with the mechanism and allows the wheels to alter their level at any moment. (Fig. 161).

On level ground, the wheels, turn on spindles that resemble ordinary axles; on slopes, the driver regulates the change of level according to the declivity. The advantages of the cranked axle are as follows:

1) Accidents to the staff, team, and cart are avoided by its use.

2) The additional men otherwise required to support the cart in dangerous positions are not required. R. D.

1010. **The Care of Farm Implements.**

STEVENSON, L. *Ontario Department of Agriculture, Bulletin*, 300, pp. 15, figs. and diagrams. Ontario, 1923.

This Bulletin draws attention to the care which should be taken of farm implements (reaper-binders, mowing machines, rakes and tedders,

hay-loaders, ploughs, harrows disk-harrows, seeders, fertiliser and manure spreaders). It also describes the use of lubricants, and the best type of shed for machines. R. D.

AGRICULTURAL INDUSTRIES.

Plant Products.

1011. Italian Wines.

CARPENTIERI, F. *Notizie e studi sui vini italiani.* Ministero dell'Economia Nazionale, Direzione generale, Direzione generale dell'agricoltura, No. 850. Rome, 1923.

This volume gives, in addition to much interesting information on the subject of Italian wines, the analyses of 91 305 samples of must and wine which were examined in order to determine the maximum and minimum percentage of alcohol they contained, as well as 2300 analyses of wines some of which had a low, while others had a high, alcohol content. The special characters of vine-cultivation and wine-making in each Province are described and the individual differences characterising zones of similar agricultural nature, as determined by the *Catasto* of Agricultural Statistics, are reviewed. In the chemical analysis, the alcohol percentage is chiefly taken into account, as this is the principal factor upon which the commercial value of wines depends. The total chemical composition is only given in the case of wines with a low percentage of alcohol (and thus more liable to suspicion) or those of over 16°.

In the preface of the book are set forth the many causes of the variability of Italian wines. The volume concludes with a general summary giving the alcoholic strength of Italian wines from which the following data have been taken. (Maximum and minimum percentages of alcohol) :

White wines : Piedmont 14.4-6.3 ; Liguria 15.9-7.1 ; Lombardy 13.8-7.7 ; Veneto 15.8-7.4 ; Emilia 1.59-5.2 ; Tuscany 15.2-6.1 ; Marche 14.6-6.6 ; Umbria 14.4-4.8 ; Campania 14.7-6.8 ; Apulia 17.2-8.4 ; Basilicata 14.5-8.4 ; Calabria 16.2-11.2 ; Sicily 20.3-6.9 ; Sardinia 18.3-7.8.

Red wines : Piedmont 16.3-6.1 ; Liguria 16.0-6.1 ; Lombardy 14.7-5.0 ; Veneto 15.3-5.4 ; Emilia 15.0-5 7 ; Tuscany 16.0-4.5 ; Marche 14.7-6.2 ; Umbria 14.2-6.6 ; Lazio 16.3-6.1 ; Abruzzi and Molise 17.2-4.8 ; Campania 15.3-5.7 ; Apulia 24.2-9.1 ; Basilicata 14.0-6.6 ; Calabria 19.2-9.7 ; Sicily 20.3-5.5 ; Sardinia 19.0-7.7. F. D.

1012. Possibilities of Industrial Alcohol in South Africa.

Report of the Industrial Alcohol Committee of the Advisory Board of Industry and Science. *The South African Journal of Industries*, Vol. VII, No. 1, pp. 32-35. Pretoria, 1924.

The industrial alcohol problem is considered from the following standpoints :— sources of supply, cost and analyses of raw materials (*e. g.* maize,

molasses, sweet potatoes, sugar beet, prickly pear, potatoes, acorns, straw, sawdust); plant and methods of fermentation and distillation, production other than by fermentation; cost of production, forms of State encouragement, if desirable; collection of data and publications upon the subject; specification of denaturants for motor fuel. M. L. Y.

1013. **The "Strength" of Wheat and Flour and its Determination.**

LAPSLEY, R. G. *Journal of Department of Agriculture, Western Australia*, Vol. 1, No. 2, pp. 115-121, figs. 4. Perth, W. A. 1924.

It is usually agreed that the factors controlling strength are: (*a*) quantity of gluten present in the flour; (*b*) physical properties of the gluten; (*c*) diastatic activity of the flour.

No method has yet been found to supersede the actual baking test for strength, where absolute accuracy is required, but the method is slow and requires a comparatively large quantity of flour, which is a handicap to the plant breeder.

It was found by GUTHRIE of New South Wales that the largest and best loaves are obtained from flours which have the power of absorbing the largest amount of water, and the test was found to give a valuable index of the relative strength of a flour. The method has proved sufficiently reliable to supply information of commercial value to millers, and it has been used in the selection of strong wheat varieties such as "Comeback", "Bobs", "Jonathan", "Carrabin" and others

The method may be described briefly as follows:— Weigh out 40 gms. of flour and make into dough with water run in from a graduated burette. The water is added until a dough is made of such consistency that it can be drawn out to a fine thread six inches in length. Should the thread break before this length is reached, insufficient water has been added; more water must be run in and a further trial made. A simple calculation gives the amount of water absorbed by a sack of flour weighing 200 lb.

In the official laboratories errors have been reduced by the employment of a mechanical mixer for the dough and the standardisation of the method. W. S. G.

1014. **The Industrial Utilisation of Bananas.**

WINCKEL, M. Bananen-Industrie. *Chemiker Zeitung*, Year 48, No 38, pp. 178-179. Cöthen, 1924.

The following products can be made from bananas if their preparation is carried out where the fruits are grown (Mexico): banana flour, banana malt, dried bananas, essential oil, liqueur, wine, cacao, chocolate and banana preserve.

The unripe banana contains 80 % starch and 3-4 % of sugar. As the fruit matures, the ratio of these substances is gradually reversed so that in the ripe fruit, there is about 70 % sugar (of which 40 % is saccharose and 30 % invertase) and only 2 % starch.

Banana flour is made from the pulp of the unripe banana. The dessiccated bananas are formed into blocks which are sent to Europe where they are used in the manufacture of banana flour and banana cacao.

Banana flour is chiefly composed of starch and is exclusively used for food purposes ; if 25 % of wheat flour is added, it is excellent for making biscuits. On being subjected to special treatment, banana flour becomes very rich in sugar and transformed into banana malt, which is used in making banana cacao and chocolate.

There are several methods of extracting from ripe bananas the essential oils much used in the preparation of liqueurs, preserves and other luxury articles. Banana spirit can also be obtained as a secondary product of the essential oil industry. Wine is also manufactured from bananas, excellent sweet and dry types having been obtained by using the dregs of the liqueurs as a ferment.

A large proportion of the weight of the fruit (40 %) is made up by the skins which, as they have a certain nutritive value, can be fed to stock.

A German-Mexican Company is being started in Mexico to exploit local products including bananas. G. B.

1015. Containers in Oil-Presses.

BONNET J. (Directeur de Service Regional d'Oléiculture). Les scourtins en huilerie. *Revue Agricole de l'Afrique du Nord*, Year 22, No. 254, pp. 383-35. Algiers, 1924.

The author's experiments have convinced him of the superiority of alfa fibre containers over those made of ordinary alfa, or of coco-fibre.

These experiments were carried out at the Mines Cooperative with two presses exerting a pressure of 25 000 kg. and each containing olive pomace taken from the same lot of crushed olives which had been subjected to the same treatment.

Experiment with pressure of 210 000 *kg.*

Oil content of pomace on containers of alfa fibre 9.920 %	Oil content of pomace on coco-fibre containers 11.360 %

Extra amount of oil obtained per 100 kg. of pomace with alfa fibre, 1.440 kg.

Experiments carried out in 1923.

Cooperatives	Oil content of olive pomace on alfa fibre containers	Oil content of olive pomace on coco-fibre containers	Excess obtained with alfa per 100 kg. of olive pomace
Nimes	9.8 %	11.51%	1.71 of oil
Barjols	11.5	12.59	0.74
Lorguzs	10.5	11. 8	1.30
Le Beausset	11.5	12. 3	1.20

It it is calculated that in the course of one work-day a container is replenished with 5 kg. of material at least 10 times, and that alfa fibre containers yield over $\frac{1}{2}$ litre more oil than those made of other substances.

R. D.

1016. **The Use of Esparto in Paper Manufacture.**

SCAETTA, H. Impiego dello sparto nella fabbricazione della cellulosa da carta. *L'Agricoltura Coloniale*, Year XVIII, No. 8, pp. 253-274. plates, 2. Florence, 1924.

A general review of the world's production of wood pulp for paper manufacture, followed by a description of the "Pomilio" electrochemical process employed in Italy for the extraction of cellulose with special reference to esparto. Details are given of the distribution in North Africa; an analysis of material coming from the Bengasi district; botanical characteristics; chemical composition of the fibre; percentage of cellulose obtained and quality of pulp. A comparison is made between Spanish, Algerian, Tunisian and Tripolitanian varieties. Reference is made to other Libyan products which can be used as a source of cellulose.

M. L. Y.

1017. **Oak Bark from Palestine as a Tanning Material.**

Commercial Bulletin, Department of Customs and Trade, Government of Palestine, Vol. V. N° 57. p.. 294-296. Jerusalem, 1924.

Samples of bark from the branches and roots of *Quercus coccifera* have been examined at the Imperial Institute, London, to test the tanning value for use on goat skins, used for water containers.

The tannin content of the branch bark was found to be 24.9 % compared with the root bark 13.9 %. Further examples will be examined before drawing any general conclusions as to the comparative richness. There appears to be very little difference in the character of the leathers produced.

M. L. Y.

1018. **"Gas" Storage of Fuit.**

Researches by the British Food Investigation Board. *South African Journal of Industries*, Vol. VII, No. 5, pp. 356-359. Pretoria, 1924.

Report of the investigations made in England to improve the system of utilisation of fall of temperature of the atmosphere at night in the storage of fruit; the best system of tubing for lowering the temperature of small fruit stores; the permeability to certain gases, notably carbon dioxide, of wall coverings and building materials. A series of tests have been made in each case and the results are noted.

A large scale experiment on the "gas" storage of apples was made near Cambridge (England) and results are noted of the average gross return obtained by sale after storage. In certain cases, the increase amounted to as much and even more than three times the former value.

Other points noted during the experiment were :— gas storage in trays is better than gas storage in boxes ; apples from grass land store better than apples from cultivated land ; the use of oil wrappers is essential.

M. L. Y.

1019. **Drying Prunes in Oregon (United States).**

WIEGAND, E. H. *Oregon Agricultural College Experiment Station, Bulletin* 205, pp. 1-26, figs. 14. Corvallis, 1924.

Although the principles of dehydration are well known the importance of standardization of the dried products is urged. The author discusses the necessity for sanitation in handling the fruit, the desirable harvesting methods, preparing the fruit (grading, lye dipping, trays), and the two general types of drying — natural draught and mechanical draught. The tunnel drier is accepted as the best natural-draught process in use ; illustrations are given of the influence of temperature, humidity and velocity of air circulation. Specifications which should be insisted upon when establishing a natural draught Oregon tunnel drier are stated. As regards the mechanical draught tunnel, work has been done at the Oregon Station with the object of simplifying the construction and economy of operation. A more uniform product has already been obtained (see figures).

A description is given of the sizing (nine point system) and the method of processing. The steam method has proved preferable to the water system. Reference is made to the packing equipment and the market system adopted by the Oregon Growers' Co-operative Association.

M. L. Y.

1020. **Hastening the Coloration of Lemons.**

DENNY, F. E. (Bureau of Chemistry U. S. Department Agriculture). *Journal of Agricultural Research*, Vol. XXVII, No. 10, pp. 757-769, bibliography. Washington, D. C., 1924.

Owing to the lack of uniformity in colour and quality of fruit obtained by the various methods employed in the packing houses, experiments were started to determine the identity of the gaseous constituent responsible for the coloration of fruit, the effect of temperature on rate of coloration, and the conditions preventing or refarding the rate of colouring.

Results indicated that when forced colouring is desirable, the change from green to yellow is hastened by the use of combustion gases from kerosene stoves, but that the effective constituent must be among the unsaturated hydrocarbons. Ethyline even in low concentration caused the change from green to yellow. Fruit coloured thus did not differ in any noticeable way from that obtained by stone gas treatment, but high concentration appeared to retard colouring, and absence of oxygen was an effective preventive. The rate of colouring increased with temperatures from 57° to 82 F., but a reduction in rate was observed at 93°F. Both ethylene and stove gas increased the rate of respiration of lemons.

The effects upon green lemons of many other substances, including carbon monoxide, acetylene, methyl chloride, formaldehyde, acetaldehyde, pyridin, amyl acetate and chlorine were tested. M. L. Y.

Animal Products.

1021. **Sterilising Milk in a Closed Vessel without an Autoclave.**

GORGERAT, G. Note sur un procédé de stérilisation du lait en vase clos sans autoclave. Stérilisation en mouvement dans le vide. *Le Lait*, Year 4, Vol IV, No. 35, pp. 394-397. Lyons, 1924.

Sterilisation is the only practical method of preserving milk. The author has tried to eliminate as far as possible the causes of the changes taking place in milk heated for 15 minutes at a temperature of 115°C. in a closed vessel. Milk subjected to this treatment takes on a disagreeable cooked taste, smells of tallow and sulphuretted hydrogen and is dark in colour. He found that milk heated only to 115°-120° C. caramels very little if it is shaken constantly when heating, and especially if it is heated in a vacuum. The tallow taste due to the oxidation of the fat when heated in the presence of air, is not present in the absence of air. Sulphuretted hydrogen is only liberated between 75°C. 80°C., therefore it can be got rid of if the milk is well aerated after being heated to this temperature. Boiling for a short time in a partial vacuum of 400 to 500 mm. of mercury is sufficient to entirely remove the smell. The milk can be heated before homogeneisation and then cooled quickly.

By means of corking the bottles under a vacuum (Hermeticos system) the author has succeeded in completely sterilising Paris milk (that had been drawn from the cow and pasteurised 18-20 hours previously ; acidity 21-23), without depriving it of the appearance of fresh milk. It had only an almost imperceptible cooked taste, no flavour of tallow or smell of sulphuretted hydrogen and kept perfectly after heating in an autoclave at 37°C. for 150-250 hours.

He also sterilised milk in the air in a solution of nitrate of sodium boiling at 115°C (1400 gm. of the salt in 1000 gm. water). In this case, aluminium bottles were used of the type of the Havre Tréfileries and sealed with aluminium caps 2-10 mm. thik. In 5 minutes the temperature inside the bottles rose to 113°-115°C. ; the bottles were shaken throughout the sterilisation process. The cost of the operation is very low. All that is necessary is to keep the temperature of the solution up to 115°C. and replace the water that evaporates so that the level of the liquid remains constant. Boiling takes place at 115°C. at which point the temperature remains constant. Sodium nitrate attacks aluminium to an insignificant extent and its effect can be neutralised by the addition to the bath of a little sodium silicate which covers the bottle with an impermeable layer. This method of sterilisation has the additional advantage of allowing manufacturers of sweetened condensed milk to sterilise the milk completely before condensation, and at the same time, to obtain a product with the natural white colour of fresh milk. F. D.

1022. **Adulterated Acid as a Possible Source of Error in Testing Milk by the Babcock Method.**

PETERSEN, E. W. M. (Division of Dairy Husbandry, University of Minnesota, University Farm, St. Paul, Minnesota), *Journal of Dairy Science*, Vol. VII, No. 4, pp. 361-369, tables 3. Baltimore, 1924.

The commercial sulphuric acid used in the BABCOCK method of testing the fat percentage of milk, assumes a dark colour and loses its strength when kept for some time owing to the impurities it contains and the organic substances with which it comes into contact. The author's experiments were undertaken with a twofold object: 1) to ascertain whether by adulterating sulphuric acid it is possible to increase the fat percentage as given by the BABCOCK method; 2) to find out the manner in which such a fraud could be detected.

Since sulphuric acid reacts quickly on all the solid constituents of milk except the butter-fat, the only adulterating substances that can be used fall into 3 groups:

Group I. Fats or oils; cream, lard, cotton-seed oil, maize oil, linseed oil, olive oil, codliver oil, whale oil and various mineral oils.

Group II. Fat solvents, gasoline, benzine, ligroin, xylol, kerosene and ether.

Group III. The solvents of group II saturated with the fatty substances of group I.

The author studied the effect produced by all the substances of these 3 groups upon the colour, density, and activity of the acid and on the fat column. He also determined the proportion between the amount of the foreign substance added and the changes effected in the fat column. Six samples of each substance were prepared: 200 cc. of commercial sulphuric acid + respectively 0.5; 1; 1.5; 2; 2.5 and 3 % of the adulterating substance. From each of these samples of adulterated acid were taken 10 parts of 17.5 cc., to which were added samples of the same milk divided into the BABCOCK fractions. A control experiment was carried out with pure sulphuric acid.

The results obtained from the experiments were as follows:

1) Most of the substances of group I, when added to commercial sulphuric acid, increase the fat column, the introduction of 2 % causes the increase to vary from 0.65 % (acid + lard) to 1.25 % (acid + whale-oil). All these substances float upon the surface of the acid make it syrupy and dark in colour, but do not affect its activity.

The fat column is usually of a dark colour.

2) The majority of the substances in group II float on the surface of the acid, but produce no change in its appearance or activity; when added to the sulphuric acid, they cause a slight rise in the fat column which assumes a light amber colour. Duplicate experiments do not give similar results.

3) Saturated solutions of fat in gasoline, benzine, and xylol exert no perceptible effect upon the appearance of the acid for 1 ½ hour. The activity of the acid does not appear to be altered, the fat column gen-

erally becomes light amber-coloured. The addition of nearly all these solutions to the acid produced a rise in the fat column. Duplicate experiments gave concordant results within the allowed limits variation.

4) The presence of any substance that has been added to the acid and is able to cause an increase in the fat column, can be detected easily by making a blank experiment with the acid, viz., by pouring the quantity of acid usually employed for testing into water instead of introducing it into the milk. P. D.

1023. **The Relation between Yeasts and Moulds and the Keeping Quality of Butter.**

SHUTT, D. B. (Department of Bacteriology, Manitoba Agricultural College, Winnipeg, Canada). *Journal of Dairy Science*, Vol. VII, No. 4, pp. 357-[illegible], Table 1. Baltimore, 1924.

Butter made from pasteurised cream is frequently much contaminated by microorganisms in the course of its manufacture, and the author undertook this study to ascertain the relation that exists between the presence of yeasts and moulds and the keeping property of butter. Analyses were made of 573 samples which had been taken by means of a sterile instrument. The butter was conveyed to the laboratory at night and the following morning the samples were analysed by the ordinary method of growing cultures on gelatine plates. The culture medium was composed of must + agar-agar, no yeast being added; the medium was acidified to 5% by the addition of a sterile, lactic-acid solution. The must had been previously clarified, filtered and sterilised in the laboratory.

Twenty one samples were set aside and placed in the refrigerator at a temperature of −12.2° C. for 6 months, the analyses being carried out at different times during that period.

Flavour standard employed by the Ontario Butter Grading Station.

Minimum for special quality	flavour 41
» » quality 1	» 39
» » » 2	» 37
Inferior quality	» 37

The results of the various analyses showing the extent to which the butter had been contaminated by yeasts and moulds were summarised by the author in a table from which the following data have been obtained.

Effect of high yeast content. — Out of the 21 samples, there were 9 containing over 100 000 colonies of yeasts and less than 2 moulds per cc. Of these 9 samples, 1 was of special quality, 4 of quality 1 and 4 of quality 2 according to the findings of the first analysis. The first 5 samples contained good types of yeast that imparted a delicate flavour to the butter. After 6 months the 9 samples deteriorated and 4 were classed as of inferior quality.

Effect of low yeast content. — 5 samples with less than 200 yeast colonies and less than 2 moulds per cc. were all classed as being of first quality when analysed on arrival ; after 6 months, 3 still were graded as first-class, but 1 had lost ½ a point and another a whole point. In all cases, however, these samples retained their flavour better than other which contained a large amount of yeast.

Effect of moulds. — 7 samples contained over 100 colonies of moulds per cc. ; 4 of these also contained 100 000 colonies of yeast. Of these 4 samples, 3 proved first-class when they were first analysed which was probably due to the presence of good types of yeast, and also to the fact that the moulds were still in the spore stage and had not had time to germinate and produce mycelium. The results of the final analyses made after 6 months showed the samples to have deteriorated, one of them having fallen from special quality to grade 2.

Butter made from pasteurised cream and churned with as little exposure to contamination as possible retains its qualities much better that butter made from pasteurised cream that has been allowed to become contaminated before churning. F. D.

1024. **The Conditions of the Development of Moulds on Frozen Meat and the Food Value of Mouldy Meat.**

Monvoisin, A. (Professeur à l'Ecole du froid, Chef de travaux de chimie et de physique à l'école vétérinaire d'Alfort. Les conditions du développement des moisissures, sur les viandes congelées et l'appréciation des viandes moisies. *La Revue Générale du Froid et des Industries frigorifiques*, Year 5, vol. V, No. 7, pp. 238-239, Paris, 1924.

The growth of moulds upon the surface of frozen meat depends upon : 1) contamination ; 2) the environment. Germs, or spores, are present on all meat, it is only their number that varies. They are derived from the contents of the intestine and the soiling of the meat at the time of dressing.

The same microorganisms are carried to all parts of the carcase by the hands and instruments of the worker and the cloths used for drying up the blood and wiping the carcases after the dressing operation is concluded. The greatest cleanliness is therefore necessary to prevent contamination. It is advisable to wash the carcases of large animals in distilled water.

All kinds of meat of whatever origin are found to be infected. Other sources of infection are to be found in the cloths wrapped round the quarters, if they are used without previous sterilisation, and in the dust that falls on the meat during handling and cutting up.

Finally, the room where the meat is stored may be responsible for a superficial contamination varying in degree according to the care taken to keep it clean and disinfected.

The condensation of the damp of the room may also carry down spores and deposit them on the surface of the meat, but the germination of these microorganisms depends upon the conditions of ventilation, moisture and temperature.

When mouldy meat is examined, the fungoid colonies are found in

particular spots viz., on the dirtiest patches where there is little, or no ventilation, so that the moisture content of the air is very high. Damp and temperature are very important and interacting factors. The chief purpose to be considered is to prevent spore germination by keeping the temperature of the air sufficiently low and not reheating the air superficially.

Retarded appearance of	Ordinary temperature	Conservation at — 5° C and — 9°C	
White colonies of mould	2 days	2 months	2-3 months
Coloured » »		3 »	4-5 »
Spore-producing moulds	5-6 days		

The rapid development of the moulds is due entirely to the heating of the room. When the meat has to be stored for an indefinite time, the temperature should be kept below the maximum of — 9°C., in which case there is no need to regulate the hygrometric conditions.

The existence of moulds is revealed by the presence of characteristic patches that find their way sometimes beneath the surface and cause an unpleasant smell. These patches which are of variable size, are first white or pale, but later become yellow, brown, black or green.

At the beginning, they can be removed by wiping; later, when the colonies produce spores, the meat must be slightly thawed on the surface so that the fungi can be picked out.

The chemical changes taking place in mouldy meat produce abnormal smells, especially a strong mousy odour. This is, however, not detectable in the cold-storage room and only becomes perceptible after the meat has been slightly thawed.

From the hygienic point of view, these alterations have no effect upon the wholesomeness of the product, therefore the consumption of meat that is simply mouldy cannot be prohibited, but it should not be exposed for sale until the moulds have been removed.

R. D.

PLANT DISEASES.

Plant Parasites.

1025. **Species of Peronospora found in the Iberian Peninsula.**

González Fragoso, R. Peronosporáceos conocidos actualmente en la flora ibérica. *Boletín de la Real Sociedad Española de Historia Natural*, Vol. XXIV, No. 6, pp. 505-562, figs. 2. Madrid, 1924.

A revision and enumeration of all the species of the genus *Peronospora* that have so far been observed in the Iberian Peninsula: 27 of the species hitherto attributed to this genus were found to belong to it, but 8 were transferred to nearly-related genera.

In the opinion of the author, the Iberian Flora contains many other species of this fungus that have not yet been mentioned, or described.

G. T.

1026. **Application of Nitrogenous Fertiliser to Unhealthy Vines.**

Moreau, L., and Vinet, E. Fumure azotée des vignes qui dépérissent. *Bulletin de la Société des Agriculteurs de France*, Year LVI, No. 2, pp. 39-40. Paris, 1924.

Organic fertilisers are regarded as the remedy to be applied to all vines that appear unhealthy and out of condition, but this treatment if carried out indiscriminately without due regard to the cause of the trouble may prove very injurious.

In excessively damp, clay districts, the vines frequently do not thrive, but in such cases, it is useless to have recourse to a nitrogenous fertiliser until the permeability of the soil has been improved by liming. Afterwards a compost of organic waste products mixed with an excess of lime may prove useful. Lime is especially needed where the soils are acid, but should the land be very calcareous so that the vines yellow and die, nitrate of sodium can be used with good effect, whereas the liberal application of an organic manure only increases the mischief, since in the course of its decomposition, it liberates carbon dioxide in the soil.

When the unsatisfactory condition of the vines depends on root, or stem diseases, nitrogenous fertilisers give no results. The diseases must be cured, or their spread checked, by the application of carbon disulphide.

In old vineyards, many of the vines are killed annually by the disease known as "Esca" ("apoplexy"), and the application of a nitrogenous fertiliser has been found merely to increase the mortality, unless it has been preceded by the specific treatment of the disease (dressing with alkaline arsenate of potash or sodium), which restores the vigour of the vines so that they are able to benefit by the application of nitrogen.

A. C. M

1027. ***Mastigosporium Lupini*, a Hyphomycete Parasitic on *Lupinus albus* in Italy.**

CAVARA, Fr. Di una infezione crittogamica del Lupino, *Mastigosporium Lupini* (Sor.) Cavara. *Rivista di Patologia vegetale*, Year XIV, Nos. 1-4, pp. 13-14. Pavia, 1924.

A crop of lupin (*Lupinus albus* L.), planted in the Naples Botanic Garden in October 1923 was attacked by a Mucedinacea, recognised by the author as belonging to the genus *Mastigosporium* Riess, as soon as the seedlings had attained the height of 15-20 cm.

The first evidence of the parasite was the appearance of round, rust-like patches on the leaf-blades and later, all these leaves, even the young terminal leaves, curled up, withered and finally fell off.

The disease which spread through the whole lupin crop in November 1923, was not arrested by the low temperatures that distinguished the following weeks, but succeeded in maintaining its ground until January 1924.

The species of *Mastigosporium* observed in Naples is precisely similar to the fungus decribed and figured by SORAUER under the name of *Pestalozzia Lupini*, which although it attacked various species of *Lupinus* very severely in Germany in 1898, it left *L. albus* wholly untouched. From its morphological characters it is clear that this parasite should no longer be included in the genus *Pestalozzia*, but ought to be transferred to the genus *Mastigosporium*, therefore *M. Lupini* (So.) Cavara = *P. Lupini* Sor.

The injury done to the crop can be greatly reduced if the first leaves attacked are removed and burnt as soon as the appearance of the fungus is reported. G. T.

1028. **The Wilt Disease of Safflower in India.**

JOSHI, S. D. *Memoirs of the Department of Agriculture of India, Botanical Series*, Vol. XIII, No. 2, pp. 39-46, tables 3. Calcutta, 1924.

During the winter of 1920, at Pusa, and later on at Sankni in the district of Bulandschahr (United Provinces), a disease to which the author has given the popular name of " wilt disease of safflower ", made its appearance for the first time on *Carthamus tinctorius* L., a Composita cultivated in many parts of India where it is of increasing economic importance. The author believes the pathogenetic agent to be *Sclerotinia sclerotiorum* Massee which may therefore now be added to the few species of *Sclerotinia* so far reported in India.

The fungus described as *Rhizoctonia Napi* West by SHAW and AJREKAR is identical with *Scl. sclerotiorum* and should be called by that name.

The bases of all the plants of *Carth. tinctorius* attacked by *Scl. sclerotiorum* were enveloped in a thick white mycelium. Large black sclerotia formed just below the level of the ground on the surface of the collar and of the roots to which they adhered loosely.

The mycelium also develops in the softer tissues of leaves and stem

and destroys the cells, which become as structureless mass. The fungus hyphae penetrate into the internal tissues of the stem and invade the pith where they produce large black sclerotia. When the seedlings are thus attacked they speedily succumb, the older plants are more resistant and although they lose their vigour, are able to persist for some time and even bear fruit (achenes) which are apparently normal, but when mature they contain badly developed seeds or else are completely empty. If the plants are suffering from an advanced stage of the disease, the flower-heads easily separate from the receptacle leaving behind the external involucre of bracts ; this is due to the formation of large pyriform sclerotia within the receptacle, which becomes transformed into a pulverent mass.

Low temperature and excessive damp are factors favourable to the grown of the parasite. The latter has been grown on many different media. It appears that the sclerotia retain their vitality for a little over one year, but are killed by immersion for five minutes in water at 50°C.

Young seedlings of safflower that have been inoculated with pieces of hyphae obtained from a pure culture of the fungus, damp off very quickly and become covered with a thick growth of mycelium, which late produces sclerotia. When young plants were inoculated with the fungus at the level of the soil they soon died, while the parasite spread in the soil and quickly made its way to the healthy plants in the neighbourhood, which rapidly succumbed

Artificially inoculated plants of wheat, oats, chick-peas, mustard, peas and potatoes quickly contract the disease. Of the various weeds, *Chenopodium album*, popularly known as " bathua " and *Asphodelus tenuifolia* (" pyazi ") have proved highly susceptible to *Scl. sclerotiorum*, whereas *Argemone* is less susceptible, and *Melilotus indica* was not attacked at all. Control measures to be recommended, the careful collection and destruction of all infected safflower plants and parts of such plants, ploughing so as to bury deeply any sclerotia that may be present in the soil ; the systematic and radical extirpation of all weeds. G. T.

1029. *Helminthosporium Allii*, n. sp., Hyphomycete Injurious to Garlic in Italy.

CAMPANILE, G. Su di una nuova malattia dell'aglio dovuta ad *Helminthosporium Allii* n. sp. *Nuovi Annali dell'Agricoltura*, Year IV, No. 1, pp. 87-106, figs. 13. Rome, 1924.

Plants of the so-called " white garlic " sent from Fucino were found on investigation at the R. Stazione di Patologia at Rome to be attacked by a disease that causes considerable damage to the crop and is due to a new species of *Helminthosporium* to which has been given the name of *Helminth. Allii* Campanile.

As far as is at present known, the " red garlic " appears immune.

The fungus attacks by preferrence large bulbs of the white garlic that have grown in liberally fertilised, irrigated, or damp, soils.

The inner surface of the tunics covering the various bulbils, as well as the flower-stem, and the leaves, of the white garlic, which were already dry

when the specimens were examined, proved to be covered with a black powder found to be partly composed of the hyphae but chiefly of the conidia of the parasite.

The chief characteristic of this new *Helminthus* is the formation of elliptical, or roundish, patches with irregular borders and varying in size from a few millimetres to one centimetre. These patches occur beneath the concentric coats usually on the surface of one, or more, of the bulbils of the same bulb. The diseased bulbils may be contiguous or separated from one another by healthy bulbils. The patches also are found on the sides, or apex, of the bulbils, but very rarely occupy the surfaces of contact, though they frequently cover the entire back of the bulbil. The patches, which may be regarded as actual cankers, are at first but little depressed; they are light-brown in colour, but are occasionally, though rarely, surrounded by a narrow violet-red border; afterwards a halo with silvery lights makes its appearance in the centre of the patch which then becomes very depressed and has a jet-black, velvet-like surface.

The presence of these depressed patches can easily be detected even by examining the exterior of the diseased bulbils without removing their concentric coats.

The author gives a very detailed description of the microscopic characters of the disease as well as of the life-history of the fungus producing it and of the development of the parasite in artificial cultures.

In addition to the conidiophores with their respective conidia, other small bodies were observed. These were very dark brown in colour and proved on microscopic examination to be composed of a mixture of hyphae and of short conidiophores bearing conidia.

Under natural conditions, *Helminth. Allii* frequently forms other small bodies that occur only on the upper part of the tunic which is free from the bulbil. These bodies are evidently perithecia, but the contents of those so far found have been very little differentiated.

When the fungus is cultivated in artificial media, sclerotia form at once, although under natural conditions, they do not make their appearance until some time after the bulb has been attacked by the fungus.

By means of inoculation with conidia taken from cultures, or from naturally-infected bulbs, the disease can be artificially produced relatively quickly and with all its characters, both in the bulbs and on the living aerial portions of "white garlic". G. T.

1030. ***Trametes Pini*, A Polyporacea reported as Injurious to the Himalayan Cedar (*Cedrus Deodara*) (India).**

Singh, Sher. The Liability of Deodar to the attack of *Trametes Pini* (Brot Fr) in Lolab, Kashmir *The Indian Forester*, Vol. I, No. 7, pp. 361-365. Dehra Dun, Allahabad, 1924.

The deodar had hitherto been believed on the authority of Hoge to be immune from the attack of *Trametes Pini*. On the strength of this conviction, Hoge recommended the substitution of individuals of *C. Deodara* for pines infested with *Tr. Pini*.

Observations made in the valley of Lolab (Kashmir) have shown that the deodar is also injured by *Tr. Pini*. This valley, which contain large pure stands of *C. Deodara* and of that tree mixed with *Pinus excelsa*, has the richest forests in all Kashmir, or indeed in the whole Himalayas, as far as the above-named species are concerned and is the only part of India where *C. Deodara* is attacked to any considerable extent by the fungus.

Here, however, on $^1/_5$ of the total area occupied by *C. Deodara* (nearly 100 square kilometres), 1262 infected trees were counted. The total number of individuals of *C. Deodara* giving clear signs of the presence of the parasite (as shown by its sporophores) may be estimated at about 2500, while if we take into account all the trees that are in close contact with these infected individuals, and therefore to be considered as having contracted the disease, although still apparently healthy, the total number of trees harbouring *Trametes Pini* is about 10 000.

Young, as well as older trees are liable to attack, but the susceptibility to the fungus increases with the age of the host.

There is hardly any doubt that the first species infected is *P. excelsa*, not *C. Deodara*. On an area of 40 sq. km. covered by *P. excelsa*, no fewer than 1120 diseased pines were counted, and as these had not been removed at the right time, the disease rapidly spread to all the neighbouring trees.

Tr. Pini attacks the heart of the wood in *P. excelsa* which becomes more or less completely rotten, whereas in the case of *C. Deodara*, the fungus hyphae only invade a ring of wood that first turns yellow and afterwards assumes a dark tint. Logs or beams from a diseased tree contain hollows corresponding to the woody zone attacked that sometimes form points of less resistance. In the most serious cases, several rings may be attacked or cavities form as a result of the decomposition of the wood by the parasite, so that the timber is useless.

The disease may spread by root infection (inoculation) as well as by wind-borne spores. Another source of infection is the existence of certain temples and shrines on the borders of the forest, for since all trees growing in the proximity of such holy places are sacred, no native would dare to touch them. If, as has been found at Dorus-wain and at Chandigam, the pines surrounding these shrines belong to the *P. excelsa* variety, they often become centres of infection, for they are liable to attack from *Tr. Pini* as they grow older and owing to their sacred character, cannot be removed. It has not yet be decided whether infection in such cases is spread more by inoculation or by spores, but probably both agencies are equally active. Where, however, an isolated diseased tree occurs in the midst of apparently healthy individuals, it may safely be concluded that the wind must here be the chief agent in disseminating the fungus; this is pratically proved by the fact that the sporophores are arranged on the tree in such a manner as to catch the wind. The number of sporophores found on a single tree varies from 1 to 4 or 5, or even more. Trees attacked by *Tr. Pini* are very liable to be overthrown by the wind or broken down by snow

Unless the authorities adopt special measures to check the spread of the fungus in the Lolab valley, the economic damage caused to the timber will continue increase every year. G. T.

Weeds.

1031. ***Cuscuta Cesatiana* reported on Red Clover near Trento.**

L. B. Una cuscuta nuova per noi. *Bollettino del Consiglio Agrario Provinciale dei Consorzi Agrari distrettuali, dell'Istituto Provinciale di S. Michele, del Consorzio della Provincia e dei Comuni Trentini e della Società Asseln Scuole Agrarie del Trentino*, Year XXXVIII; No. 7, p. 148. Trento, 1924.

Cuscuta Cesatiana (1) which of late years has infested the luxuriant weeds growing plentifully on the uncultivated land round the town of Trento, has just been found for the first time on cultivated red clover in a field not far from "Maso Desert". G. T.

Animal parasites.

1032. **Locusts in Italian Somaliland.**

(Communicated by the Italian Colonial Ministry to the International Institute of Agriculture).

It is possible to obtain only very vague and uncertain information in Italian Somaliland respecting the invasions of locusts (called "aiàh", "ludai", "caugian" in Somali, and "inzicki" in Swahili).

Little is known as to the periods when the insects appear, their origin, the direction of the flights and the length of time they remain in the invaded districts. It appears certain, however, that for about ten years no flights of locusts have been seen in the Colony. The natives, especially the older ones, remember having seen several invasions, but they cannot give any exact dates, although they still retain lively recollections of a painful character of the two last visitations, that destroyed all their "sciambe" thus leaving them quite destitute. The first invasion, which occurred in the basins of both the Scebelli and the Juba (the insects penetrating as far as the dunes), took place during the second rainy season (Agay) in June-July, 1905, while the second which occurred in 1912-13 during the third rainy season (Der), did less harm at the time, for as the season was far advanced, most of the insects resumed their flight and perished in the Indian Ocean.

In 1913, however, during the first rains (Gu), the eggs laid at the time of the second invasion on the dunes between Merca and Brava, hatched out and produced vast numbers of locusts which, during their larval and nymph stages caused great havoc for several months in the surrounding districts and subsequently on reaching their adult stage, consumed all the crops of

(1) In the *Index Kewensis* (Oxford, 1895, Vol. I, p. 673), *C. Cesatiana* Bertol is given as a synonym of *C. australis* R. Br; Adr. Fiori (in Fiori and Paoletti's *Flora analitica d'Italia* Padua, 1900-1902, Vol. II, p. 391) states, however, that *C. Cesatiana* is a variety of *C. Australis*. (*Ed.*)

dhurra and maize and finally directed their flight towards Abyssinia whence the preceding invasion had come.

As far as can be ascertained, these pests always appear suddenly. Some days before the actual invasion, the natives notice small nuclei of flocks preceded and followed by a large number of falcons, crows, storks ibises, etc., birds which it is well-known always accompany locusts, upon which they largely feed, and are a sure sign that the destroying hosts are very near and are still advancing. The natives believe that these hordes come from long distances, mostly from Abyssinia, although a small proportion of the insects come from India or Uganda, and that they only exceptionally propagate themselves in Somaliland, as they are known to have done, in 1913, on the dunes of Merca.

The 1905 invasion is supposed to have been due to the flocks of locusts that first descended upon the Colony of Erythrea, in July-August of the same year in their way to Abyssinia, where they destroyed everything and then directed their course to the Red Sea, where they perished.

The methods of locust control adopted by the natives are limited, very primitive and quite ineffective. They mainly consist in heading the insects off from particular fields, but if the locusts are few in number, they succeed in attacking the neighbouring plots. To scare away the pests, a dense evil-smelling smoke is produced by burning boughs mixed with putrid litter and wet straw, or else the natives make deafening noises with drums and petroleum tins.

The genera and species of the locusts that invade Italian Somaliland at longer, or shorter, intervals have not yet been determined. The natives know only that the body and wings of these insects are of a fine uniform golden-yellow without any special spots, or markings.

The Somali do not condescend to eat these insects, but the Arabs and Swahili consume them with avidity.

1033. *Euplectus bicolor* Parasitic on Macrolepidoptera belonging to the Family of the Noctuidae in North America.

LACROIX, DON S. The Occurrence of an Important European Parasite in North America (*Hymen. Elachertidae*). *Entomological News*, Vol. XXXV, No. 6, p. 217. Philadelphia, 1924.

During the latter part of July, 1923 the author discovered in a cranberry bog situated in the territory of Kingston (Massachusetts) and infested with caterpillars of *Agrotis nigrum* L., one dead larva of this Macrolepitopteron that was enveloped in a kind of cocoon. The author succeeded in rearing from this caterpillar several specimens of a parasitic hymenoptron that reached their adult stage on July 26 of the same year. This parasite was identified by A. B. GAHAN as *Euplectrus bicolor* Swederus (fam. *Elachertidae*), and L. O HOWARD stated that the insect was an important natural enemy of Noctuidae in France and Italy, though it had never before been reported from North America.

G. T.

1034 **The Biological Control of the "Olive Fly" (*Dacus oleae*) in the Province of Tarragona (Spain) in 1923** (1).

La labor efectuada por el Consejo Provincial de Fomento de Tarragona contra la mosca olearia in 1923, con la cooperacion de los técnicos. *Boletin mensual de Arboricultura y elaboración moderna del aceite de oliva*, No 67, pp. 444-445. Tortosa, 1924.

In 1923, the "Mancomunidad" of Catalonia (Spain), in co-operation with the "Consejo Provincial de Fomento" of Tarragona, made some attempts to introduce and acclimatise the Braconid Hymenopteron, *Opius concolor* Szépl., an endophagous parasite of the "Olive fly" (*Dacus oleae*). An entomological expert was sent to Tripolitania to visit the olive-growing zone of that Colony and collect pupae of *Dacus oleae* that had been parasitised by *Opius*. The material obtained was transported to Ulldecona where 13 375 individuals of the hymenopteron were subsequently set at liberty over a zone of nearly 6 km. in extent. In addition, 30 000 pupae of the parasitised "fly" were kept till the following spring and thus a further supply of the parasite was obtained. During the summer, the hymenoptera that had been set at liberty and those reared in the laboratory propagated themselves freely. When it is found that the insect is capable of resisting the severe cold of winter an acclimatisation demonstration will be given in the Ulldecona laboratory.

The further search for other native parasites of *D. oleae*, in addition to the Calcid hymenopteron, *Eupelmus urozonus*, an ectophagous parasite reported in 1922, led to the discovery in the following year of another ectophagous parasite, the Calcid *Eulophus longulus* Zett., which was obtained in large numbers from olives coming from Tortosa, Campredó, Ullecona and Roquetas. On the other hand, the olive sent from Tarragona as in the 1922), only furnished individuals of *Eupelmus*

The experiments made with two other European Calcids, *Eurytoma rosae* Nees and *Dinarmus dacicida* Masi though to be ectophagous parasites have so far given negative results. At Campredó, the dipteron *Myopites limbarae* Schin. which is often parasitised by *Eur. rosae* and *Eup. urozonus* was discovered on the Composita, *Inula viscosa*, but only *Eupelmus* was obtained from this specimen. G. T.

1035. **Note on the Measures taken for Control of the Olive Fly (*Dacus oleae*) in Greece during 1921.**

A Communication made to the International Institute of Agriculture by M. C. A. Isaakides, Chief of the Phytopathological Service of Greece at Athens.

The municipal councils of the communes of Corfu, even previous to 1920, had suggested to the Ministry of Agriculture that the law on the « Caisse d'Olivier » should be extended to the island of Corfu and that in consequence, the Phytopathological Service should undertake the control of *Dacus oleae* throughout the entire island. As a result of my report on the

(1) See also *R.* 1923, No. 323 and *R.* 1924, No. 213. (*Ed.*)

work carried out for combating this pest in Chalcis, Pelion and Triphyllia, these Municipal Councils repeated their former request to the Ministry of Agriculture.

At this time, similar requests had been submitted to the Ministry of Agriculture by the Municipal Councils of the Communes of Leucadia, the Municipal Council of Prevesa and by many other Communes of the various olive-growing destricts. In 1921, the Ministry of Agriculture decided to carry out measures for the control of *Dacus* throughout the whole of Corfu, Leucadia and the territory of the Commune of Prevesa.

The island of Corfu is 619 square kilometres in extent and the whole surface is covered almost uninterruptedly by one of the largest olive-gardens in the world. The continuity of this vast olive plantation is only broken by the highest peaks of two mountain chains and a few vineyards situated on the lower ground. The olive-tree is the source of all the wealth of the island and this wealth is daily increasing. Corfu is very densely populated. The Corfiot, who is of an artistic temperament, works slowly, but very carefully. In many places, his wife assists in the cultivation of the olive. The women of Corfu are very industrious as a rule and are accustomed to carry heavy weights upon their heads. In some parts of the island, malaria is a great scourge. Corfu is provided with a network of good roads all suitable for vehicles and with an abundant water-supply for the work of controlling *Dacus*, for there are several streams and two or three small rivers and countless wells. The ponds, or marshes, which are fairly common form centres of malaria. The olive-trees are very large, especially those of Rodhas, which are fine, prolific trees.

According to Statistics published by the Ministry of National Economy, the total number of olive-trees in Corfu is only 2 367 000, but we have found over 3 200 000 in the course of our investigations.

Olive-oil is the only product of the island, it is of excellent quality and fetches high prices in countries to which it is exported. In seasons of heavy crops when *Dacus* is absent, or does not develop much, the total oil production exceeds 300 000 Ionian casks (one Ionian cask = 52 *Ocques* or 66.560 kg. (1). Frequently however in Corfu, as in other olive-growing parts of Greece, *Dacus* causes great losses, by reducing the output to $^2/_3$ or less, and lowering the quality of the oil 50 % below the regulation standard. The crop of 1913-1914 was estimated at 250 000 Ionian casks and 70 drachmas (2) were paid per cask for oil made from sound olives, whereas the oil from parasitised fruit only fetched 40 drs. The olive-fly reduced the output by 100 000 Ionian casks and caused losses amounting to 7 200 000 drachmas to the producers and 900 000 drachmas to the State Bank.

Before 1921, some enlightened olive-growers, large landowners, as well as the Director of the Corfu Experiment Garden, adopted various measures against *Dacus*. In 1923, M. KOTSOPOULOS, the Director of the above Garden, tried the basin method on some thousands of trees, and in 1914,

(1) one *ocque* = 1.28 kg

(2) one gold drachma = 9. $^{33}/_{64}$ d. at par.

on 6000 trees, but unfortunately he met with as little success as the large landed proprietors who followed his example.

The olive-gardens of the island of Leucadia (St. Maure) are not continuous like those of Corfu, but are interrupted by extensive vineyards. The Leucadian native grower knows how to use the sprayer ; he is hard-working and at certain seasons goes to the Patras district to assist in the cultivation of the so-called " Currant vines ". In Leucadia, as in Corfu, there are plenty of wells and some streams, while in the higher lying districts, communal, or private, reservoirs exist which collect the rain and supply the inhabitants with drinking water. There are many marshes which are infested by mosquitoes and form centres of malaria infection. In some districts the two first sprayings are carried out with the water of these reservoirs (the owners being duly compensated) but for the subsequent sprayings an insecticide is used. This must be prepared in the vicinity of wells that frequently take more than two hours to reach from the olive-yards, whence the mixture is carried by pack-animals over bad roads.

According to the Statistics of the Ministry of National Economy, Leucas possesses only 676 426 olive-trees, we however found the number to exceed 1 100 000. As in Corfu, olive-oil is the only product and great losses are occasioned by the depredations of *Dacus*.

Prevesa possesses a magnificent and very thick olive-garden, which surrounds the town on every side that is not washed by the sea. As the ground of this olive-garden is flat, vehicles can traverse it in all directions. In the centre of the olive-garden, there are four wells where the insecticide for destroying the olive-fly can be prepared, but the farmers of Prevesa do not know how to handle a sprayer. This olive-garden contains 170 000 trees which, in spite of the fertility of the soil and the regularity of the surface of the ground have been left neglected and unpruned, with the result that the crop depends upon the greater or less activity of *Dacus* and not upon the efforts of the cultivators.

As in the previous year, the " Dacus " Control Service in the regions where it worked was organised in the following manner : The Island of Corfu was divided into three areas each of which was subdivided into sections. The general management of the service was entrusted to M. J. Sordinas, Departmental Professor of Agriculture in Corfu (a Corfiot by birth who knows his country well and has done much work on the subject of the olive-tree) and M. Panaghiotis Tonfexis, Department Professor of Agriculture of the Cyclades (who acquired much experience during the previous season). M. Sordinas directed operations in the 2nd and 3rd areas while M. Tonfexis occupied a similar position in the 1st area. The Heads of sections were chosen from farmer students of Agricultural Schools. The following table gives the number of trees and the names of the various sections of Corfu.

Sections	Olive-trees	Heads of sections
1st area		
Maghoulades	360 000	Marcoulis
Karoussades	324 000	Ceconomopoulos
Elisképeees	300 000	Christodoulou
Sinies	271 000	Touris

Sections	Olives-trees	Heads of sections
2nd area		
Donkades	300 000	Ghoulatis
Korakjanas	252 000	Moschovakis
Aphras	272 000	Valianos
Mesis Kekyras	400 000	Tomaras
3rd area		
Stronghylis	157 000	Philippopoulos
Aghion Pathaion	262 000	Papahioannou
Leukinis	272 000	Jonkas.

The island of Leucadia was divided into four sections entrusted to M. S. KOTSOPOULOS, Director of the Corfu Experiment Garden, and to M. S. ZOUKAS who had worked in Pelion the preceding year. As M. KOTSOPOULOS was obliged to be absent from Corfu from time to time on account of his duties at the Experiment Station, M. M. K. PANAGLIOTATES and Th. KOLLIOPOULOS were associated with him. The following table gives the number of trees and the Heads of sections in Leucadia.

Sections	Olive-trees	Heads of sections
Leucas	260 000	S. KOTSPOULOS
Carya	131 000	»
Nydri	330 000	S. ZUCAS
Vassiliki	372 000	»

The district of Prevesa consists of a single section under the management of M. N. BABIOTIS of the Departmental Service of the Province of Aitolo-Acarnia.

In 1921 the work was more difficult than in 1920, for no expert staff could be obtained and molasses, sodium arsenite, proper sprayers and the necessary funds were all lacking, hence the work was begun very late and had to be interrupted when about half done. The result was that in the most vulnerable parts of Corfu "Dacus" made its appearance about October ; its presence was however, merely of entomological interest and had no practical importance.

The same mixture for killing *Dacus* was employed as in the preceding year ; the composition was as follows :

Arsenite of sodium	3	ocques
Molasses	100	»
Water	1000	»

The mixture was prepared in the manner described in my report of the work in 1920 (1). A barrelful (150 *ocques*) is made at a time. In order to avoid the trouble of weighing all the ingredients each time, a small tin vessel containing exactly 180 drachmas was used for the sodium arsenite, while the molasses were put into a petroleum tin in which two holes were impossible to comply with this request and towards November 5, 1921, the inhabitants of Paxo informed me that infested fruits were falling in

(1) See : *R.* 1922, No. 350 ; See also Int. Inst. of Agric. *La lutte contre la mouches de olives dans les divers pays.* Rome, 1922, pp. 87-89. (*Ed.*).

made at the exact height of 14 *oques*. The insecticide was transported, instead of being prepared on the spot, on pack-horses or mules. As the transport animals were not strong enough to carry two metal receptacles containing a total of 80 *oques*, 6 petroleum cans full of the insecticide were loaded on each horse, or mule. This, however, entailed loss of time and of money, for on one hand, the metal receptacles were more easily filled and emptied, and on the other hand, the amount of insecticide transported in them was larger. In Corfu, over very uneven ground covered with olive-trees, the insecticide was carried for a certain distance on the backs of animals and then by women to the places where the treatment was given.

In certain districts, the cost of animal transport was so high that it paid better to have the insecticide carried to the spraying centres by women, this plan was adopted by M. TOURIS throughout most of the Synics sector and also on a smaller scale in Læucas. In the Prevesa Sector the mixture was carried in carts.

The staff of each spraying shed was composed of: 1 foreman, 8 sprayers, 1 preparer, 1 or 2 assistant preparers (sometimes these were women), 3 or 4 porters with pack animals sometimes assisted by women, or 1 porter with horse, or mule, and cart, 1 child or one woman for carrying water or other small jobs. The topography of the region, the distance of the preparation station from the place where the insecticide is used, the cost of labour and other local conditions often necessitate modifications in the staff. Sometimes owing to want of understanding on the part of the heads of the spraying centres, the staff is not rightly composed. The workers of Corfu, Læucas and Prevesa have no knowledge of sprayers and therefore the deficiency had to be made good by the Service.

In Læucas, one man sprays 800 to 1000 trees daily, whereas in Corfu and Prevesa, only 500 trees are treated by a single man in one day. The foreman was paid 15 drachmas per day at Corfu in 1921, the workers handling the sprayers were given 13 drachmas, and the porters with pack-animals 20 drachmas. In Læucus, the daily wages were as follows: foreman 18 drachmas, workers handling sprayers 12 drachmas, assistants and preparers 10 drachms, porters with pack-animal 20 drachmas. At Prevesa the foreman received 20 drachmas, the workers 12-15 drachmas, the porter with horse (or mule) and cart 30 drachmas.

All Heads of Service when sent to their posts were given instructions respecting their work, and were requested to investigate their sections and to make a plan of the ground, marking the roads and water-supplies, noting the density of the olive gardens and all other factors affecting the operations to be carried out for the control of *Dacus*. They were also instructed to keep a diary of work, and a pay-roll and to forward at the end of each month a brief summary of all work done. Further, they were required to record the rain, its duration and intensity, together with the general condition of the weather and any factors that might influence the development of *Dacus*.

In the course of the operations in 1920, it was found to be necessary to discover some means of substituting sea-water for fresh water in the preparation of the insecticide. I therefore requested my Heads of Service to make

experiments for this purpose on a large scale. So far, I cannot however hazard any opinion on the question.

The first treatment was carried out at Corfu on June 16, and towards the end of the month, was being generally applied. The campaign ought to have been begun earlier, especially in the most vulnerable districts where *Dacus* commences its attacks soonest. In many places, parasitised olives are met with early in July ; a little later, the galleries of the caterpillars of the first generation are found in the fruits. At Leucas, the first spraying began on June 20, and at Prevesa on June 24 ; but in both cases it should have been commenced early in June.

The second treatment began on August 4 in Corfu, on July 23 in Leucas and early in August in Prevesa.

The third treatment began on October 20 in Corfu, on August 2 in Leucas, and on September 10 at Prevesa.

The fourth treatment began on October 20 in Corfu, on October 11 in Leucas and on October 12 in Prevesa.

The spraying was begun in the lowest, most vulnerable and earliest-attacked districts and afterwards extended to the higher ground. In each of the Sections, there were as may spraying-sheds as was necessary to enable the succeeding treatment to be carried out in the lower areas, as soon as the previous treatment was finished in the higher districts. At Prevesa each treatment lasted a fortnight.

In order to demonstrate clearly the efficacy of the treatments, some olive-yards were left unsprayed to serve as a control at Corfu, Leucas and Prevesa.

In Corfu we left the olive garden on the Kato-Garonna Commune as a control, for the Municipal Council there, for some reason unconnected with *Dacus*, had not requested that any means of destroying the parasite should be adopted in its territory. Part of the adjoining Synarades olive-garden was also left as a control as were also 35 isolated olive-gardens in the so-called " Chalikouna " district, together with the olive-gardens of the small neighbouring islets on the north side of the island, Erikonssa, Mathraki, and Othonus which are covered with olive-groves resembling those of Corfu as regards their climatic conditions. In the Kato-Garonna and the " Agios-Ghordios " olive-gardens, *Dacus* appeared on September 7, and was found there in large numbers on September 20. The injury caused by the parasite, by the beginning of November led to a loss of 40 % of the crop.

The olive-gardens of the islands of Paxo were also left intreated. These islands are situated to the south of Corfu. They are covered with olive trees of the same variety as that found in Corfu but the olives produced there are of better quality than the Corfiote olives. The inhabitants of the Paxo islands sent numerous memoranda to the Ministry of Agriculture and requested in 1920 to be allowed to join the " Caisse d'Oliveir " in order to be able to combat *Dacus* on their own territory. In 1921, they repeated their request and explained to the Ministry of Agriculture that their whole revenue depended upon the olive-trees which were regularly destroyed by the parasite. For want of apparatus and the various substances required for making the spraying mixture, the Phytopathological Service found it

large numbers from the olive-trees. About November a mass attack of the olives was in progress. If the crop had not been attacked the oil production would have risen to 1 170 000 " ocques " and the price of the Ionian cask would have been 300 drachmas. As, however, 95 to 100 % of the olives were damaged by " Dacus " the output of oil was only 480 000 *ocques* while the price per cask fell to 260 drachmas.

At the same time 100 % of the olives growing at " Mondre " a place situated on the coast of Epirus opposite the south portion of Corfu and where the meteorological conditions were similar to those of Corfu, were falling to the ground, infested with " Dacus " grubs.

The Commission appointed (with the Prefect of Corfu as President), for the purpose of investigating the results obtained by combating *Dacus* in the island, mentions the fact that this insect attacked the olive-gardens left as controls.

In the island of Leucadia, the Municipal Council of the Commune of Allessandra made no request that any measures for destroying the parasite should be taken and the olive-gardens of this Commune were therefore left untreated, as controls. The " Poratias " olive-garden on the coast of continental Greece and only separated by a narrow strait from Leucas was similarly left unsprayed. Until September little sign of any *Dacus* attack could be observed in these olive-gardens, but later on the depredations of the insect were very evident. Any one travelling along the road from Leukas to Vassiliki could notice that the olives growing in the gardens that had been sprayed were bright green, whereas on reaching the edge of the olive-gardens of Allessandra, 80 % of the fruit were black and fell if the branches were slightly shaken. After the rain of October 15 and 16, only a few olives remained on the trees and these were as much infested with grubs as the fruits already lying on the ground. The olive-growers were greatly distressed and bitterly reproached the Mayor of the Commune whom they even threatened to attack, at the same time demanding compensation from the State. The olive-garden of Peratias had been ruined in exactly the same manner as the olive-garden belonging to the Commune of Alleessandra.

At Prevesa, none of the olive-cultivators would consent to leave their trees untreated.

The efficacy of spraying was also shown there by the injury done to the adjacent olive-gardens of the Commune of Perga that had been left untreated, in spite of the requests of that Commune, whereas the fruit of the Prevesa olive-gardens remained healthy and yielded a large crops.

In accordance with the provisions of law 1330 dealing with the creation of the " Caisse d'Olivier ", and with a view to the protection and pruning of the olive-trees, and also in accordance with the Royal Decree amending law 214, a compulsory tax equal to 25 % of the tax already paid to the State, has been levied for the benefit of the " Caisse d'Olivier " [Olive Bank] on the oil of Corfu and Leucas. In the case of Prevesa, this tax was fixed at 0.02 centimes per " ocque " of oil. A tax of ½ centime was levied on the whole region.

The Ministry of Agriculture, in conjunction with the Ministry of Finance and the Ministry of the Interior, has instituted in Corfu, Leucadia

and Prevesa, Commissions composed of Government, financial, and Communal Authorities, as well as of olive-cultivators and dealers in oil and olives. The Presidents of this Commission are the Prefects of Corfu and Prevesa and the representative of the Prefect of Leucas, who have received a mandate to investigate regularly the results obtained from the control of *Dacus*.

The Commission composed of the Prefect and the Tax Collector of Corfu, the President of the Commune of Corfu and two land-owners cultivating olive-trees, drew up under date of November 18, 1921, its report on the results obtained in the " Dacus " campaign until that date.

The Commission appointed to investigate the success of the " Dacus " campaign was formed of the Prefect of Corfu, the Tax-collector of Corfu, the Head of Customs in Corfu, the Vice-President of the Corfu Chamber of Commerce, the President of the Communes of Afra and Karoussades, and also of olive-garden proprietors, owners of olive-mills and dealers in oil and olives, assessed the benefit accruing to the olive-growers, the State Bank and the island of Corfu respectively at, 42 000 000 drachmas, 5 352 250 drachmas, 270 000 drachmas. The island of Corfu benefited to this extent owing to the special tax imposed.

A similar Commission was appointed in Leucas. It consisted of the Secretary of the Magistrate, the Leucas collector of Taxes, the President of the Commune of Leucas, the President of the Commune of Tsoukalades, two proprietors of olive-gardens and two owners of oil mills.

The benefits resulting from the " Dacus " control were assessed as follows : 15 000 Ionian casks of oil, or 3 900 000 drachmas, for the olive cultivators ; 83 200 drachmas for the State Bank, and 88 200 drachmas divided amongst the Communes, the port and the Rural Police Bank.

Finally, another Commission formed at Prevesa of the Prefect, the Prevesa Tax Collector, the President of the landowners of Prevesa, and of olive-growers and owners of oil-mills estimates the benefits resulting from the " Dacus " campaign at 1 000 000 drachmas for the olive-growers, and 140 000 to 150 000 drachmas for the State Bank.

From what has been stated, it is seen that by treating only 4 470 000 olive-trees, the Phytopathological Service has succeeded in increasing the return from the olive-crop 45 900 000 drachmas, while it has obtained a revenue of 6 351 050 drachmas for the State and has enriched Corfu and Leucas by 360 200 drachmas as a result of special taxes.

The Manager of the National Bank of Greece in his annual report of the economic and financial condition of the country for 1921, has written the following lines on the subject of the work of our Phytopathological Service.

" One fact that deserves special mention is that it was the State Service that contributed to obtaining this rich harvest for Corfu inasmuch as it undertook the systematic control of *Dacus*. The portion of the crop that was saved solely by this campaign is valued at 40 million drachmas. Since the injuries caused by *Dacus* can greatly reduce the olive-crop (sometimes by as much as 80 %), it is evident that a general campaign against this pest should be undertaken both in the interests of national economy and for the sake of the State. It is to be hoped that every effort will be made to carry out the campaign this year, which is one of heavy yields

and hence, given favourable meteorological conditions, the oil output should be large ".

(Report presented by the Manager of the National Bank of Greece to the General Meeting of the Shareholders on March 12, 1922).

In November 1921, I had the great pleasure of meeting in Corfu, Prof. M. F. SILVESTRI, who had come to the island in order to see our work and estimate the results obtained. At this date, the treatments were finished, but one spraying-centre was at once set to work to show him how the operation was performed. M. SILVESTRI noticed the strong smell of molasses that permeated the olive-gardens. We visited in his company the districts most regularly and severely attacked by " Dacus " which I myself had not before investigated. We went to the olive-gardens of Kato-Garonna and the isolated plantations of " Chalikonna ". Unfortunately, bad weather supervened at this point and prevented our visiting the islands of Othon, Paxas and Læucadia. M. SILVESTRI had a very limited time at his disposal. He examined the fruits which at this season were all on the trees, in spite of the storm that had occurred a few days before our visit. M. SILVESTRI gathered samples for examination in his laboratory and made enquiries among the olive growers as to how the condition of the olive-crop compared with that of previous years ; and also asked questions on the general results of the " Dacus " campaign. One of the largest olive-garden proprietors of Corfu, M. LASKARIS, who knows Italian and whom we found working among his olive-trees, gave a very emphatic answer to M. SILVESTRI when the latter asked whether in the best seasons when the trees had been very prolific and when the Dacus-fly was not present, the olives had ever been as sound as in 1921 : " Never, never never ", he replied.

M. P. SILVESTRI, in his letter of December 2, 1921, spoke in the most laudatory terms of our work in the control of *Dacus*. He confided to me his belief that the question of " Dacus " control has, however, not yet been solved and he gave the reasons for his conclusion. He supplied me with the number of the olives gathered at Corfu on November 15 which he found to be attacked by *Dacus* when he investigated them, after they had been in his laboratory until December 6. The number of infested olives from the gardens that had been treated, were of little practical importance but were of a certain amount of entomological interest.

Finally he advised me to adopt *Dacus* control measures for several consecutive years in the same district, in order to bring out most clearly their effect upon the " Olive-fly " and in a general way, upon the entomological fauna of the olive-garden, as well as upon the olive-garden itself.

1036. ***Rhyparida australis*, a New Cotton Pest in Queensland, Australia.**

SIMMONDS, J. H. *Queensland Agricultural Journal*, Vol. XXI. Part 3. pp. 187-191, figs. 4. Brisbane, 1924.

The cotton plantations of the district of Wooloога were recently found to be suffering from a severe, though strictly localised, attack of *Rhyparida australis* Boh. a Chrysomelid coleopteron which is fairly common in Queensland and had been found already in large numbers on the bark of eucalyptus trees. For the present, it may be regarded as a parasite of

secondary importance, although local environmental conditions have evidently caused the insect to increase enormously and the cotton-plant fored a convenient, if unaccustomed, host.

A few individuals of another Chrysomelid, *Goloptera scitula* Lea. were also found associated with *Rhyp. australis*, but the injury to be attributed to them was probably negligible.

Although *Rhyp. australis* had never been found in cotton-plantations before December 24 1923, large numbers of this insect were reported as present there after three days had elapsed. In the most infested places, on one cotton plant about thirty centimetres high, from twenty to thirty of the beetles might be counted. Young plants between four and six weeks old were the most severely attacked, while those of about two months old were little injured, and seedlings of less than three weeks appeared completely immune, although no apparent reason for their being avoided by the parasites could be discovered. *Rhyp. australis* became a serious pest for the space of about one week, after which its numbers fell off considerably. During the hot hours of the day, the beetle rests under the leaves, or between the terminal shoots, or even amongst the clods of soil; at nightfall it comes out to feed and eats the outside soft tissues of the stalk just above the insertion of the leaves. Sometimes its depredations are confined to a narrow strip encircling the stem, or lateral shoot, but this is enough to cause the part attacked to wither, bend towards the ground and finally perish. Little harm is done by the leaves themselves being destroyed, for though in serious cases where all the leaves are stripped off, the defoliated stalk dies, if only a few leaves have been devoured, the plant succeeds in throwing out fresh lateral shoots.

In larger plants which have been more or less deprived of the apex of their principal stem, the place of the latter is taken by new lateral shoots that grow at the base of the injured stalk. Abrasions are present on the stems and petioles, hence the plant assumes a distorted deformed appearance and its growth is serious checked. The recent injuries were confined to the stalk which hung down from the point where it had been ringed by the parasite.

In order to control *Rhyparida australis*, light-traps with kerosene lamps were employed as soon as its presence was reported. Thousands of the beetles flew towards the light and were destroyed. To insure obtaining the best results, it is necessary to choose large light traps that should be placed between the rows of the plants. If the plants are shaken on all sides to dislodge the insects they harbour, these pests will be attracted by the light and fly towards it. G. T.

1037. ***Sericothrips gracilipes* n. sp., a Thysanopteron Injurious to Cotton in Mexico.**

Hood, J. D. A New *Sericothrips* (Thysanopteron) Injurious to Cotton. *The Canadian Entomologist*, Vol. LVI, No. 6, pp. 149-150. Orillia, 1924.

No species of *Sericothrips* of any economic importance has before been reported.

Now, however, the Thysanopteron collected in October 1917 in the

county of Tlahualilo (State of Coahuila) Mexico and described in this paper as new to science under the name of *Seric. gracilipes*, has proved very injurious to cotton. This insect, in association with another Thysanopteron, *Heliothrips phaseoli* Hood, found to be very injurious to beans in 1908, at Brownsville (Texas), and in Matamoros (Mexico), but not described until 1912, has produced a disease ("bronze", or "copra") of cotton leaves and thereby rendered valueless the cotton growing on thousands of acres.

G. T.

1038. ***Eriophyes gossypii*, A Mite Injurious to Cotton in Bahia (Brazil).**

BONDAR, G. Uma nova doença do algodoeiro. *A Lavoura. Modernas*. Year IX, Nos. 4-5, pp. 11-12, figs. 2. Rio de Janeiro, 1924.

In several parts of the State of Bahia (Brazil), cotton-plants have frequently been observed with deformed, curled-up leaves having on their upper surface small irregular protuberances that correspond to the depressions covered with a felt of hairs situated on the lower surface of the leaf. Quite healthy plants may be found growing by the side of these diseased specimens, further, the condition of the branches of the same plant varies greatly, some are severely attacked, others are but slightly affected, while others again remain perfectly normal.

This disease which is caused by the mite *Eriophyes gossypii* Bks. is new to the State of Bahia where it does not appear to spread rapidly.

The author is of opinion that it is impossible to adopt any remedial measures because no spraying can have any effect upon the mites that congregate in the depressions on the lower surfaces of the leaves.

As a preventive measure, it is advisable to root up and burn all the cotton plants in a given field before sowing the new crop.

It is also well to adopt the precaution of disinfecting the seeds with carbon disulphide before sowing.

G. T.

1039. ***Trichoporus gallicola* sp. n. and *Prodecatoma philodendri* n. sp., Chalcid Hymenoptera Living on *Philodendron* spp. in Paraguay.**

FERRIÈRE, CH. Note sur deux nouveaux Chalcidiens phytophages du Paraguay, suivie d'une étude sur la structure de leur tarière. *Annales de la Société entomologique de France*, Vol. XCIII, 1st and 2nd Quarters, 1924. Pp. 1-21, figs. 22. Paris, 1924.

In the course of his scientific expedition in South America (July-August, 1914) which was undertaken with the object of studying the flora of Paraguay, Prof. R. CHODAT of Geneva was struck by the quantity of small larvae infesting the ovaries of *Philodendron*. All the inflorescences of this *Aracea* which he examined in every part of the Republic were invaded by these caterpillars and hence rendered completely sterile. Numerous small Hymenoptera were found flying in the proximity of the same plants.

These insects proved on examination to belong to two different species

of Hymenoptera of the family of Chalcididae. The author has described them in detail as being new to science.

Both of the species observed are enemies of *Philodendron* spp. and live side by side on the plants. One, *Trichoporus gallicola* sp. n. (sub-family *Eulophinae*, tribe *Tetrastichini*) is much the commoner and makes small galls inside the ovary, while the other, *Prodecatoma philodendri* sp. n. (sub-family *Eurytominae*, tribe *Eurytomini*), lives on the tissues of the ovary sheltering it. There is, however, no connection between the two insects, and though sometimes *Prodecatoma* may destroy its neighbour by devouring the galls together with their occupants this is quite accidental.

The number of galls found in one ovary varies much in the same species and still more in different species of *Philodendron* ; there seems to be some connection between the number of galls and the number of the ovules contained in the ovary.

Trich. gallicola has been seen in the galls present in the ovaries of *Phil. Selloum*, *Phil. dubium*, *Phil. undulatum* and *Phil. petraum*.

Prodec. philodendri has only been discovered in a very limited number of ovaries belonging solely to *Phil. Selloum* and *Phil. dubium*.

The large amount of material at his disposal enabled the author to make some interesting and little known observations respecting the ovipositor of these two new Paraguayan phytophagous Chalcids. G. T.

1040. ***Prays Citri* Millière, a Rind Insect Pest of Philippine Oranges.**

Mañalac San Juan, J. *The Philippine Agriculturist*, Vol. XII, No. 8, pp. 339-348, tables 2. Los Baños, Laguna, 1924.

Results of investigations made in the territory of Los Baños (Philippines) from April 1922 to February 1923 with the objects of obtaining information regarding the life-history and habits of *Prays citri* Millière and the injury it does to the citrus crops.

The Microlepidopteron is common throughout all the Archipelago where it annually proves to be one of the worst enemies of citrus fruits.

The female insect lays its eggs one at a time, and usually at night, on the lately-formed fruits, but rarely on the flowers. On the other hand, in India and the Mediterranean region, the eggs are normally deposited upon the flowers alone.

The incubation period lasts from 6 to 12 days, with an average of 8.36 days in the Philippines. As soon as the caterpillar is hatched, it makes its way beneath the rind of the fruit and being in close proximity to the pulp, lives at the expense of the soft tissues while at the same time, it induces the formation on the exterior of the fruit of a very prominent tumour that is opened by the caterpillar when fully developed and reaches to leave its hiding place in order to pupate

In India and the Mediterranean region, however, the grub as soon as it is hatched, takes up its position in the flower which it destroys. In cases of serious infestation, it is possible to find in the Philippines as many as twenty to thirty tumours on the same orange, so that the entire surface

of the fruit is covered with these swellings. The attacks of the caterpillars reduce the amount of the crop and, in many cases, hinder the development of the fruits. Such oranges as reach maturity in spite of the presence of the parasites are deformed and unsaleable owing to the numerous swelling on their surfaces.

In the Philippines, the larval stage of *Prays citri* lasts from 49 to 58 days, with an average of 53.36 days. The chrysalides are found there on the outside of the fruits, generally in the cracks in the rind, or in sheltered places on the leaves, or at the junction of the twigs and the branches, but in the Mediterranean region and India, they ensconce themselves also in the floral internodes. The chrysalis stage lasts in the Philippines from 4 to 6 days, with an average of 5 days. The adult insects, when in captivity, have lived as long as 18 days.

Pr. citri has been found to attack the following species of citrus (given in descending order of susceptibility) : *C. sinensis* Osbeck, known locally as " cajel ", *C. decumana* L. (*C. grandis* Osbeck), popularly called " lucban "; *C. aurantifolia* Swingle ; *C. medica* L. ; *C. limonia* Osbeck ; *C. hystrix* DC.

The percentage of the infested fruit on each tree ranges from a maximum of 78.23-84 % (*C. sinensis*) to a minimum of 0-4.54 % (*C. hystrix*). The number of tumours present on a single fruit vary from a maximum of 28-30 (*C. sinensis*) to a minimum of 1-2 (*C. hystrix*).

Under the conditions obtaining at Los Baños, the macrolepidopteron develops during the fruiting season of the citrus trees. As soon as the trees, especially if they happen to be *C. decumana* and *C. sinensis*, are in fruit, the caterpillars of *Pr. citri* make their appearance. The number of these pests is larger, or smaller, according to the amount of fruit borne by the trees, therefore the larvae swarm in April, May and August, but their numbers are considerably reduced between October and December.

No natural enemy of *Pr. citri* has so far been found in the Philippines.

Encouraging results were obtained from spraying the trees with petroleum emulsion in August, September and December 1922 and in January 1923. The insect appears most susceptible to the action of the petroleum during its chrysalis stage. G. T.

1041. ***Chermes armiger* n. sp., an Aphis Living on *Pinus monticola* in Idaho (United States of America).**

ANNAND, P. N. A New Chermes from Pine (*Hemiptera Aphidae*). *The Canadian Entomologist*, Vol. LVI, No. 1, pp. 5-6, fig. 1. Orillia, 1924.

A new species of *Chermes* described under the name of *Ch. armiger* has been found on *Pinus monticola* in Idaho (Hayden Lake, Kootenay County). The life-history and habits of this aphis are still unknown.

G. T.

CURRENT NOTICES

Legislative and Administrative Measures.

1042. **Germany. German Wine-Growing " Bezirke ".** — The *Reichsgesetzblatt* of May 2, 1924 contains an announcement respecting the formation of vine-growing districts. It is proposed to create 37 *Bezirke* which will be situated in the States of Prussia, Bavaria, Saxony, Wurtemberg, Baden, Hesse, Thuringen and Anhalt.

1043. **Belgium. Measures taken in Belgium against certain Live-Stock Diseases.** — Royal Decree respecting redhibition in the case of tuberculous cows in calf, it being forbidden to sell or exchange such animals either for slaughter or fattening. — Ministerial Decree setting forth the characteristics of tuberculosis reaction. — Royal Decree regarding coital disease in horses. — Royal decree containing the measures against foot-and-mouth disease. — Decree respecting police sanitation of domestic animals. (*Moniteur Belge*, February 7, 15 and 29, 1924).

1044. **Brazil. Encouragement of Cotton Cultivation in Brazil.** — A Decree of February 1924, removes the taxes on mechanical implements, etc., for use in the cultivation of cotton and allows material required for this purpose to be transported gratis or at reduced rates to companies undertaking to grow cotton on at least 1000 hectares and set apart in addition 200 hectares for seed-selection, and to distribute a certain amount of selected seed gratis, to build a mill according to the regulations of the district, to clean the cotton at the local regulation prices, and submit to the control of the Government Inspection of the Cotton Service. The Government may also make grants under certain conditions.

1045. **Bulgaria. Veterinary and Police Regulations for Live-Stock in Bulgaria.** — In the *Derjaven Viestnik* of July 22, 1924, is published a law dealing in an exhaustive manner with veterinary regulations and sanitary measures applying to live-stock. The law treats of these matters in XI sections and 295 articles.

1046. **United States. Quarantine Measures in the Philippines for certain Agricultural Products.** — In accordance wih special orders, the following are subjected to quarantine : *Musa* and kindred plants (Ord. No. 30) ; coconuts (Ord. No. 31) ; sugar-canes (Ord. No. 32) ; rice (Ord. No. 33) ; fruit coming from districts infected with *Ceratitis capitata* (Ord. No. 34) ; pineapples (Ord. No. 35) ; bamboos (Ord. No. 36) ; tobacco (Ord. No. 37). (*Philippine Agricultural Review*, XVII, No. 1, 1924).

1047. **Spain. Provisions in Spain against Plant Diseases and for the Protection of Insectivorous Birds.** — Regulations for the destruction of *Lamantia dispar* in the chestnut woods of the district of Villanova de Cordova. Order declaring the fruit-fly (*Ceratitis capitata*) an enemy of crops. Royal Decree providing for the execution of measures for the control of the diseases of forest trees and soils. Order prohibiting the destruction of insectivorous birds (*Gaceta de Madrid*, January 20, March 13 and 15, 1924).

1048. **France. New Game Laws in France.** — Various articles of the French law under date of May 3, 1844 have recently been amended by the new law of May 1, 1924. In addition to certain regulations respecting the open seasons and the penalties to be imposed on persons infringing the said regulations, the powers of the Prefects of the Department are also defined as regards the Orders they may promulgate (after hearing the opinion of the general Councils) in respect to: 1) the time at which migratory birds, not including the quail, may be shot, the nomenclature of birds, the methods of killing birds; 2) the seasons when aquatic animals may be hunted in ponds, swamps, rivers, etc.; 3) species of injurious animals; 4) measures for preventing the destruction of birds and for encouraging their propagation; 4) the use of grey hounds for the destruction of injurious animals; 5) the prohibition of hunting while snow is on the ground. The Prefects shall further have the power to authorise individual landowners, or other persons possessing the right of hunting, to take by means of traps and under given conditions, certain species of game to be kept provisionally, and subsequently set free, in order to encourage their multiplication.

1049. **The Search for Liquid Motor Fuels to Replace Petroleum in France.** — The *Journal Officiel* of June 4, 1924, publishes a decree emanating from the French Ministry of Agriculture respecting the incentives offered to chemists and writers of memoirs dealing with the transformation of mineral and vegetable substances of Frenh origin into fuels for running explosion engines or internal explosion engines. The first class of memoirs is reserved for descriptions of the methods of transforming vegetable oils, the second class deals with the liquefaction of solid combustible substances in order to transform them into liquid carbides of hydrogen, and with the economical production of these carbides from the by-products of the distillation of coal etc. (lignites, shales and peat).

1050. **Rural Electrification in France.** — Instructions have been published for the benefit of communities desirous of instituting a rural network for the distribution of electric power. A decree has also be promulgated as to the grants to be obtained from the rural engineering funds by Departments, Commercial Syndicates for the electrification of the country districts. (*Journal officiel* of February 10, 1924).

1051. **Legislative Enactments passed in France against Black Scab of Potatoes.** — In the *Journal officiel*, of June 8, is published a Ministerial Decree prohibiting the free importation of potatoes from countries where the black scab (gâle noire, gallwart, *Synchytrium endobioticum*) is prevalent, viz. from Germany, Great Britain, Ireland, Norway, Holland, Sweden and Czecho-Slovakia. Potatoes coming from these countries must be accompanied by a certificate (the form of the certificate is given in the decree) issued

by the country of origin. Potatoes from States bordering on infected countries (Belgium, Denmark, Lithuania, Luxembourg, Poland and Switzerland) may only be imported if accompanied by a certificate also drawn up according to a prescribed form. Any potatoes not provided with such a certificate are to be refused on the frontier, or destroyed at the expense of the importer.

1052. **Morocco. The Utilisation of Colonial Allotments in Morocco.** — With a view to making up rapidly the colonial allotments in Morocco and thus hastening their utilisation, as well as with the object of assisting the holders to carry out this work on their own holdings by means of credit grants, the Sheriffian Government is disposed to guarantee under the conditions mentioned in a given contract, the remuneration resulting from these operations, to any person having the necessary implements who shall undertake to carry them out.

The main lines of the above-mentioned Contract are as follows. The Government shall fix the price of the work per hectare ; the entire sum advanced shall be paid to the clearer within a term of five years and in five annual payments dating from the day upon which the work is finished. Should these payments be defierred, the said clearer shall receive 6 % on the out-standing credit. The Sheriffian Government on its side, renounces its claim upon the first mortgage upon the holding in favour of the clearer. Should the holder of the lot fail and his property be sold before the clearer's claims are entirely satisfied, the Government undertakes to pay to the latter a minimum of 60 % of the amount of the credit and interest, and will itself purchase the said lot at a sum sufficient to cover these liabilities. (*Bulletin Officiel de l'Empire Chériffien*, March 18, 1924).

1053. **Nyasaland. Provisions made in Nyasaland against Plant Diseases and Animals Injurious to Agriculture. Protection of Wild Birds.** — In the *Nyasaland Government Gazette* of February 1, 1924, an order has been published requiring all plants and seeds introduced into the Protectorate to be sent by the Customhouse Officials to a disinfecting station belonging to the Department of Agriculture. The Department may authorise, by means of a supplement to this order, the importation of plants, or seeds, specified in a second and appended document provided the importer furnishes a certificate of origin declaring the said plants and seeds to be free from disease, or any of the injuries mentioned in a third document sent therewith. The order gives the details describing the manner in which the provisions are to be carried out.

In the same No. of February 1, 1924, of the *Nyasaland Government Gazette*, there also appears an Order for the protection of wild birds and fixing a closed period for them.

1054. **St. Vincent. The Protection of Cotton-Growing in the Island of St. Vincent.** — In March 1924, the Governor of the Island published an Order for the protection of cotton. This order abrogated the order issued in the previous year. Strict measures are adopted respecting the plantations infested by destructive insects. The Agricultural Superintendent is however empowered without issuing any previous warning, to take all necessary measures for the control of the said pests and to order, if advisable, the total destruction of trees, shrubs and grass. The order is supplemented by a regulation dealing

specially with the fumigation of cotton-seed in private establishments. In Government Stations, these seeds are subjected, after being removed from the pod, to heating up to 55° C (131 F.) in a HESS Drier for 10 minutes and are subsequently allowed to cool down.

1055. **Italy. Provisions for the Encouragement of the Wine-Making Industry in Italy.** — The *Gazzetta Ufficiale* of March 24 and of June 5, 1924, contain two Royal Decree-Laws (under date of February 24 and May 23, 1924), reducing the taxes on spirits made from the distillation of wine, "second wine", grape pomace, or other residues of wine-making.

1056. **The Protection of Typical Italian Wines.** — The creation has been authorised of Consortia between the producers and the vendors of a special typical Italian type of wine for the purpose of protecting the trade name of the said product. These Consortia are placed under the supervision of the *Ministero dell'Economia Nazionale*. By typical wines are understood genuine wines possessing special characters that are constant in the same type. The objects of the Consortia are as follows:

a) to exercise vigilance that no wines of the type under consideration shall be made or sold that do not possess the characters belonging to that type;

b) to encourage the increased production of each typical wine, by facilitating and promoting the diffusion of *suitable vines in the best localities* and improving and spreading the methods of making the said wines;

c) to make typical wines, and Italian wines in general, better known in the home and foreign markets;

d) to collaborate with the Government organs in carrying into effect the present decree and all other provisions relating to wine production and trade, with the power of bringing a civil action into Court in case of infringement of the above decree and regulations;

e) to encourage and institute studies and enterprises both in the viticultural and enological fields, that are likely to increase the production of and the trade in, typical wines and to further the wine-making industry in general;

f) to institute international conventions with other Governments, consortia and similar institutions outside the Kingdom for the protection of the exclusive right of every State to make special types of wine and to protect such products from imitation.

The membres of the Consortia have the exclusive right to use the *mark or distinctive sign of the Consortium* in addition to *their own mark or sign* and to forward together with every consignment a special certificate furnished by a Government Enological and Agricultural Institute appointed by the *Ministero dell'Economia Nazionale* and testifying to the fact that the wine possesses the characters of the typical wine of which it bears the name and the mark and sign of the Consortium. The creation of the consortium between the producers of, and the dealers in, these typical wines is left to private initiative; although independently of the constitution of a special Consortium, the Minister of National Economy may arrange for the trade in any given typical wine of considerable importance to the national economy to be regulated in the same manner as by means of the private consortia.

1057. **Poland. Measures for the Control of Plant Diseases in Poland.** — A Decree of the Ministry of Finance under date of May 31, 1924,

which supplements and amends the decree of the said Ministry of December 13, 1920. This second decree deals with the measures to be taken at the Customs, with a view to preventing the importation into Poland of plant diesases and pests in general, and especially of black scab of potatoes (*Synchytrium endobioticum*), vine phylloxera (*Phylloxera vastatrix*) woolly aphis, *Schizoneura lanigera*, S. Josés scale (*Aonidiella perniciosa*).

1058. **Uruguay. Regulations for Seeds in Uruguay.** — The Ministry of Industry has decided to authorise the *Istituto Filotécnico y Semillero Nacional* of Estanzuela to dispose of its own selected seed up to the amount of 2000 kg.; the said seed is to be distributed as a prize at the agricultural exhibitions held in 1924. The Ministry of Finance states that the General Direction of Customs may authorise the importation without the previous analysis required by the law of May 27, 1916, of any products intended for sowing provided they are accompanied with a certificate furnished by the *Defensa agricola*(. *Diario Oficial*, January 2 and 28, 1924).

Experiment Stations and Agricultural Instruction.

1059. **Germany. Bavarian Forestry Institute.** — A decree of the Bavarian Ministry of Finance contains a new order with reference to forestry research, based on collaboration between the State administrative staff and research workers and between science and practice. The section of the Exrimental Forestry Institute (Forstliche Versuchsanstalt) of Munich, has been recognised as an independant Institute; *a*) for the study of sylviculture and woods; *b*) for forest products; *c*) for State purposes and forestry upkeep; *d*) phytopathological and botanical research; *e*) chemistry and soil science; *f*) applied zoology; *g*) meteorology and climatology. (*Allegem. Forst- und Jagd-Zeitung*, Year 100, May 1924 and *Finanz Ministerialblatt*, Bavaria, No. 5, March 1924).

1060. **Prize Themes for the Higher School of Agriculture** (Landwirtschaftliche Hochschule). — For the College session 1924-25, prizes are being offered for the two following subjects: 1) the re-arrangment and coordination of reports of recent scientific experiments, collected from various sources, on spontaneous combustion of plant products; 2) comparative study of the various methods in use and of results obtained in other countries (France, Czecho-Slovakia, and United States) concerning sugar-beet cultivation, reference being made to the numerous experiments in Germany relative to the establishment of a Seed Testing Department; attention should be drawn especially to the improvement of German beet seed. Candidates are required to send their theses to the Secretary of the Hochschule not later than the 1st April, 1925. (*Chemiker Zeitung*, XLVIII, No. 72, 1924).

1061. **The Higher School of Horticulture at Berlin-Dahlem (formerly Wildpark), Centenary Festivities on 14-16 Aug. 1924.** — In honour of the occasion, a special exhibition of illustrations of antique horticulture, old prints etc., was in view in the State Art Library Hall. (*Staatlichen Kunstbibliothek*).

1062. **The State Institute for Research and Instruction in Vine Growing and Pomology, Neustadt.** — At the XVth Anniversary of the " Staat-

hohe Lehr und Versuchsanstalt für Wein und Obstbau " (Director: Prof. ZSCHOKKE) a discussion was opened by Prof. SCHATZLEIN on viticultural progress in relation to applied chemistry.

1063. **Brazil. The Agricultural Society of the State of San Paolo.** — In the State of San Paolo in June 1924, the Fruit Growers Association (Sociedade Fruttaria Paulista) was inaugurated with a view, amongst other things, of encouraging the sale of oranges. About 5 000 000 orange trees are to be found in the State. The output is in excess of home consumption and exportation is being arranged, chiefly to London and New York, where San Paolo oranges have been favourably received on the markets.

In April 1924, the Dutch cattle breeders in San Paolo formed the " Associação do Herdbook Hollando-Paulista ". The animals registered are divided into three categories: *a*) purebreds imported direct and registered in foreign herd books; *b*) purebreds derived from the above categories and of Dutch-San Paolo origin; *c*) offspring of purebreds from one of the above categories and cows of non-purebred origin. In the case of the last mentioned, two years is allowed before registration of the parent in the herdbook.

Under the auspices of the stock breeding department of the Ministry of Agriculture, the " Associação Nacional dos Criadores de Suinos " has been formed recently in San Paolo to elaborate a scheme for the improvement of stock. This includes not only the selection of purebred animals, but also the hybrids of native origin, and improved types; the animals of these two groups are distinct. The Society publishes a Review called the " O criador de suinos ". (*Revista da Sociedade Rural Brasileira*, Year V, Nos. 49-50, pp. 249-250. San Paolo).

1064. **China. Colleges of Agriculture in China.** — An increased interest is taking place throughout China in agricultural education. In spite of political uncertainty and lack of funds there has been marked progress during recent years. In June 1923 a six year review (1917-1923) was issued in English, by the College of Agriculture, National Eastern University, Nanking. The College has a staff of about 26 professors and more than twice as many assistants.

For the fiscal year 1920-1921 the total funds available for working expenses amounted to $98 070 of which $78 304 were apportioned to budget expenditures and $19 766 for extraordinary expenditures. This College is especially fortunate in the support it is receiving from business concerns in China, including the Shanghai Flour Mill Association, the Chinese Cotton Mill Owners' Association, the International Committee for the Improvement of Sericulture in China, Tung-Tai Reclamation Company and Bankers. It is also liberally supported by the Kiangsu provincial government. At the time of the report, the College valued its equipment at $30 000 approximately, not including books and general museum material. This College has now been designated as the Central agency for the control and promotion of agriculture in the Kiangsu province, and an annual grant of $50 000 has been made for this important project. The College has 7 departments — biology, agronomy, horticulture, animal husbandry, sericulture, plant pathology, entomology and utilisation of farm products. At present the College has one Central Station and at least 9 Sub-Stations totalling about 1 600 mow (approximately

750 acres) of land. The central Station is situated at Tashengkwan about 15 miles west of Nanking City and has a total area of 1800 mows of fertile land on the Yangtze river. Professor C. C. YUEN is Director of this Station with 5 assistants. The first sub-station is designated for animal husbandry and floriculture, the second for wheat, the third for fruit and vegetables and the others for cotton. Research work has recently been carried out in :-- agricultural economics and farm management, agronomy, bacteriology, botany, cotton improvement, forestry and sericulture, Approximately 70 acres are under cultivation in Nanking, and outside the city a further 35 acres and three other tracts totalling about 70 acres. The inventory of the College of Agriculture and Forestry is estimated at $38 507.61. The personnel comprises about 38 members, of which 27 are doing full time work in agriculture. Several additions to the Staff have been made recently, including two professors from the West, R. H. PORTER, from Iowa State College of Agriculture and M. L. HANCOCK from Ontario Agricultural College, the first for plant pathology and the second for horticulture.

Canton is a third centre in China where agricultural education, research and extension is being developed, Kwangtung was also one of the first provinces in China to establish a Government agricultural experiment station, known as the Kwangtung Agricultural College and Forestry Experiment Station. The station had an annual budget of about $50 000 and the College about $20 000 local silver.

The present situation in agriculture at Canton is somewhat different from that at Nanking and Peking. The College of Agriculture of the Canton Christian College, known as The Lingnaam Agricultural College is very largely an indigenous undertaking. It has been fostered and developed by the Cantonese and is not directly under western control. However, its affiliation with the Canton Christian College makes possible efficient co-operation with western business and missionary interests. The Board of Managers have provided the funds whereby it has been possible for the College of Agriculture to continue with a budget of approximately $100 000 local silver for 1922-1923 and $87 000 for 1924-1924.

The present purely agricultural Staff consists of 9 western graduates, 2 Lignaam graduates and 2 men trained at Kwangtung. A great deal of the general science instruction is carried on by the staff of the College of Arts and Sciences. More than 100 acres are under cultivation, not including the general campus of the Canton Christian College. For administrative purposes the College has been divided into 4 sections :— Education ; research ; extension ; business, and 5 departments :— animal husbanry ; agronomy ; horticulture ; manuffacturing, sericulture. The College is receiving liberal support from both Chinese and Western interests.

About one year ago Government agricultural college education was reorganised in Peking. The college known as the Peking National Agricultural College started with a staff of about 40 men, 10 or 12 of whom were graduates of Western Agricutural Colleges. This College has now been closed on account of the general unfavourable political conditions and lack of funds. But land has been secured and a yearly budget of about $100 000 has been drawn up. There will be one main station and two substations with a total area of land

of about 1000 English acres. At Peking, mission forces are also projecting a college of agriculture in connection with Peking University. With the help now received from the American Committee's China Famine Fund rapid progress should be made.

In addition to the Institutions above mentioned are others such as: the Shantung Pongee Silk Experiment Station at Cheefoo and the Shangtung Agricultural School at Tsinanfu.

Kansu province has three agricultural high schools closely affiliated with the South-Eastern University, and Anhui has two. There is an agricultural school in Honan and there are a few in other provinces.

1065. **Activities of the Agricultural Department of the Canton Christian College.** — The agronomy department is giving special attention to the improvement of rice and to fertiliser experiments, including variety tests, seed selection, fertiliser tests, both from the botanical and the agronomical standpoints. In the first season of 1923, 31 Philippine, 8 American and 22 Chinese varieties were tried. In the second crop season of the same year, 22 Chinese, 52 Philippine, 9 American, 4 Java and 1 Siam variety of rice were grown. All these are lowland types and few are glutinous.

Commercial fertiliser Companies, are co-operating with the College for carrying on fertiliser tests (ammonium phosphate with the American cyanamide Co. of New York City; Peruvian guano, fish guano and ammonium sulphate with Dodwell & Co. of Great Britain; Bowker's lawn and garden dressing with the American Agricultural Chemical Co. of New York).

The organisation of a fertiliser testing station is now being planned. The primary object of this station will be to assist exporting and importing firms in the introduction of commercial fertilisers and in their general use.

Animal husbandry. — In 1923 a silo has been built measuring 13 feet × feet which should contain 50 tons of silage. The first filling has been made with pigeon pea (*Cajanus cajan* or *C. indicus*) and native grasses. This is the second silo in China. An ensilage cutter is being provided by the Papec Machine Co. of New York which will be available in 1924.

Recently a herd of 22 Indian dairy buffaloes of the "murra" or "ram's horn" breed, originally from Delhi, India, was secured by the College.

1066. **School of Sericulture in Columbia.** — An "Escuela modelo de Serioicultura" has been inaugurated. The actual seat is not given in the decree, but is near either Guategne or Miraflores.

1067. **Denmark. Danish National Service for Land Improvement.** — The importance during the war of increasing wheat production led to the foundation in 1918 of a national agricultural Institute for research, with reference to the improvement of unfertile land, especially as regards drought and liming. In addition, it was proposed to undertake practical scientific investigation on hydraulics, etc. The National Service for Land Improvement (*Statens Grundforbedringsvaesen*) was directed by the governing body, under the control of Claudi WESTH, who, under the title of "*Norders Grundforbedring*" (Land Improvement) has published a series of articles on work already accomplished.

The two outstanding subjects for investigation were drought and liming problems, but general cultivation was also considered. Research was carried

out where agricultural organisations and private bodies had expressed the wish to collaborate with the National Service. About 10 000 military maps were elaborated for this work and contours drawn to show levels and divisions of territory.

Soil investigations have been confined to surface layers. Lime requirements are tested *in situ*, and observations made on local vegetation, plant diseases, etc., and where necessary, soil samples have been taken from every 3-5 hectares for chemical and biological analyses. The results were recorded on maps, with accompanying explanations, and these maps were sent to the head of each defined area. The average moisture conditions were determined in the spring and the results recorded.

A scheme of improvement has been projected with reference to drought. In April 1922, about 184 000 hectares were investigated and 288 000 ha. were registered for investigation, which constitutes more than 10 % of the total arable land and meadows of Denmark.

It has been estimated that about 35 800 hectares of the land suffered from excess moisture. Calculations as to lime requirements were made from 42 700 fields, and it was found that about 23 900, i. e. 57 %, needed lime.

The publications issued by the National Service for land improvement amount to about 1 000 pages and include numerous maps. The value from the economic standpoint of this work is evident. (Correspondent for Denmark, T. CLAUDI, West Jorders Grundforbedring).

1068. **United States. Forestry Service.** — The sum of $400 000 per year has been allocated to the forestry stations. The investigations include : *a*) sylviculture, forestry work in general ; *b*) utilisation of forest products ; *c*) pastures.

a) The research station consists of a central bureau and about a dozen sub-stations situated either in the forests or on private estates. Nurseries, experiment plots, forest reserved for studies or cultural work, upkeep, control against fire, hydraulic work etc., are included in the routine ; *b*) Researches on utilisation of forest products, paper pulp, improvements in manufactures, prevention of waste in timber yards and saw mills, where shavings, etc. represent 41 % of the forest production. Investigations are being made with extracts employed in various industries. *c*) Three stations for pasture problems are situated in Utah, New Mexico and Arizona and are concerned with the following questions : rotation ; re-sowing of impoverished pasture lands ; conditions suitable for various forage plants ; stock grazing as compared with housing of stock ; elimination of poisonous plants ; water supply ; recognition of right of way in forest districts. (See GREELEY'S Report. (Director of American Forestry Service) and *Revue des Eaux et Forêts*, Vol. 62, No. 7, 1924).

1069. **The Tropical Zoological Station on Barro Colorado Island.** — This new station is admirably equipped for tropical research. For information apply to J. ZETEK, Ancon, C. Z., or from Dr. T. BARBOUR, the Museum of Comparative Zoology, Harvard. (*Science*, Vol. LIX, No. 1537, 1924).

1070. **National Institute of Research on Colloidal Chemistry.** — The American Chemical Society, the National Academy of Science, and the United States National Research Council have discussed the projects for the foundation of a National Institute of Research on Colloidal Chemistry.

1071. **The Yellowstone School of Natural History and Biological Station.** — Funds for this Institute are being collected. Scientists interested in this Station are requested to assist by sending for use in its library copies of their publications on botany, zoology, geology, paleontology, forestry, ecology, and related subjects. Communications should be addressed to Dr. E. B. HARVEY, acting Director, University, Minneapolis. (*Science*, Vol. LIX, No. 1538, 1924).

1072. **Forestry Courses at the New York State College of Agriculture.** — Cornell University has designed a course to meet the requirements of teachers engaged in the subject of dendrology. There is also a course on general forestry. These courses are under the direction of Professor R. S. HOSMER, Head of the Forestry Department, Cornell University. (*Science*, Vol. LIX, No. 1537, 1924).

1073. **Haiti. A Central Agricultural School** is to be established by the Department of Agriculture and in connection with the school there is to be an experimental farm. Similar schools and experimental farms will be established in different parts of the Republic, with a view to the improvement of agriculture in the island. (*Bulletin of the Pan-American Union*, Washington, June, 1924).

1074. **Hawaii: Report of the Committee in charge of the Experiment Station, Hawaiian Sugar Planters' Association for Year ending September 30, 1923.** — During the year under report, 80 254 seedlings were set out in the fields for trial, double the number of any previous year. The seedlings were distributed amongst the various districts. The seedlings will be very carefully selected and only 15-20 % will be sent to plantations for further trial.

The most promising seedlings are summarised in the report. Many desirable plants have been obtained from Lahaina, H 109, and Striped Mexican as parents. (PRATT, J. S. B. *The International Sugar Journal*, Vol. XXVI, No. 306. London, 1924).

1075. **France: State Control of Medicinal Plants and Plant Extracts.** — An official report dated 1st July 1924, contains a report of recent work carried out since the first sitting of the special Commission in April 1918. Since then the work has included conferences, congresses, travelling scholarships, special studies, scientific work for propaganda purposes, experimentation and field tests, studies on acclimatisation and distribution of various species in France and in the Colonies and Protectorates. Twenty-eight local Committees are collaborating in this work and receive the support of the State Bureau concerning the drug products, scents, chemical preparation and distillery. The President of the Special Commission is Prof. E. PERROT, Pharmaceutical Society, Paris.

1076. **Institut du Pin, Bordeaux.** — Founded in 1920 and associated with the Faculty of Science, the Institute forms a technical centre for the resin industry of the pine forests of Lande, which covers an area of 1 000 000 hectares and possesses a laboratory for research, an industrial factory and workshops and provides a course of technical instruction. The resin from the Bordeaux-Lande district is of excellent quality; the annual output is about 200 000 quintals. The products for distillation come from about 500 pine forests and the annual

of extracts has principally been the Caréne, the quality however being inferior. Studies have been made on the extraction of turpentine, chiefly by GILINER, and also on the utilisation of pine oil as a carburant in the manuafcture of resin ether, of wood acids, on the substitution of colophony by glycerine resinate, and the use of glycerine soaps in the preparation of paper.

1077. **Centenary at Grignon.** — The " Association amicale des anciens éléves de l'école d'agriculture de Grignon " has decided to celebrate its centenary in June-July, 1926, and to hold a practical demonstration and a Congress for agricultural instruction. (*Journal d'agriculture pratique*, Year 88, No. 29, 1924).

1078. **Course of Œnology at the Agricultural Institute of Algeria.** — A special course was created in 1919 by Prof. J. H. FABRE with a view to the adaption to north African conditions of methods of wine making employed in other countries. The course is free, and open to all those who desire to acquire knowledge of wine making methods, within the period of a short course limited to one week. The instruction is purely practical, but may be supplemented by visits to the chief vintage centres of Algeria.

1079. **Agricultural Education in Dahomey.** — Dahomey is divided into 4 educational districts : Porto Novo, Holliketou, Allada, Cotonou, Ouidah and Mono ; Aboney, Savanou, and Zavnanado ; Borgou, Djougou, Atacatora, and Moyen Niger. (*Bulletin de l'Agence Générale des Colonies*, Vol. 16, No. 192, 1924).

1080. **Groundnut Experiment Station at M'Bambey (Senegal).** — The Station is reserved for groundnut cultivation and has experimental plots, plant breeding laboratory, phytopathological laboratory, etc. It is under the direct control of the Lieutenant-Governor of Senegal. (*Journal Officiel de la République Française*, March, 1924).

1081. **Great Britain. Imperial Institute of Forestry, Oxford.** — The Imperial Forestry Institute has reseently been founded at Oxford for instruction in forestry.

The Imperial Forestry Institute will be a University Institution, the Professor of Forestry being its Director. It will be under the control of a Board of Governors representing the University and Government Departments concerned, under the Chairmanship of Lord Clinton, a Forestry Commissioner. The educational work of the Institute will comprise (1) postgraduate training of probationers for the forest services and of other qualified persons, (2) training of research officers in special subjects, and (3) provision of courses for selected officers already serving. It is intended that the Institute should maintain close touch with and be of assistance to the various forestry training centres throughout the Empire. Thus, in the case of overseas training centres which have no direct means of giving practical instruction in the latest systems of management as practised on the continent of Europe, it will be one of the functions of the Institute to arrange for such practical instruction to be given by members of its own staff to students who have already completed their general course of training at their own Universities or Colleges.

If in any particular case it cannot undertake to give direct instruction, the Institute may arrange that this should be given at some other place. It is proposed, for instance, that close touch should be maintained with the Royal

Botanic Gardens, Kew, whose unrivalled resources should be of great assistance to those students who may wish to study systematic botany and economic products. Again, forest engineering is a subject which cannot be dealt with comprehensively in Great Britain, owing to the absence of logging operations on a large scale; arrangements will therefore be made as far as possible to study it practically in the forest regions of the Continent, or in certain cases in Canada. Similarly, the study of tropical silviculture from the practical point of view is impossible outside the tropics, and hence the Institute will maintain close touch with other institutions where this subject can be efficiently dealt with, such as the Forest Research Institute and College, Dehra Dun, in order that the best possible arrangements may be made in the interests of students who wish to make a practical study of tropical silviculture.

Although the Institute is intended primarily to serve the needs of Forestry in the British Empire, it will be open to qualified students of any nationality provided that there is sufficient accommodation. Nor is it by any means intended that it should cater only for the requirements of State forest services; now that timber and wood-pulp firms are becoming more and more interested in the management and working of forests on scientific and economic lines, the Institute should be of special value in providing them with fully trained employees. Students admitted to the Institute may, in fact, be included under any of the following categories: — (*a*) Those possessing a Degree on Forestry, or a Diploma or equivalent certificate of having satisfactorily completed an approved course of training in forestry, who have been selected as probationers for the higher branch of some forest service. (*b*) Graduates with honours in Science, who desire to become specialists in some branch of work connected with forestry. (*c*) Forest officers deputed to attend courses with the view of bringing their professional knowledge up to date. (*d*) Students of approved qualifications not included in the first three categories, who are admitted on the recommendation of overseas Governments. (*e*) Students with a University training in forestry who may wish to attend the Institute on their own account and at their own expense.

The course of study at the Institute will normally extend over one academic year, beginning in October, and will be made sufficiently elastic to serve the needs of individual students. The subjects dealt with will cover the whole range of Forestry, and will include Silviculture (European and Tropical), Forest Management (including Mensuration, Valuation, and working plans), Forest Botany (including physiology and anatomy of trees, mycology and pathology, ecology, and systematic botany), Forest Zoology (including entomology), Forest Utilization (including the structure, properties, and uses of wood), Soils, Climatology, Forest Economics and Policy, Forest Law, and Forest Engineering including Surveying.

1082 **The New "Sir William Dunn" Biochemical Laboratory, Cambridge.** — In May last, with the legacy of £210 000 bequeathed by Sir William Dunn, a new laboratory was instituted at Cambridge. The cost of building and equipment amounted to £90 000. The laboratory is under the direction of Prof. Gowland Hopkins. (*Chemistry and Industry*, May, 1924.)

1083 **Student's Competitions at Agricultural Shows in Cornwall.** — Since the War, students' competitions at agricultural shows as adopted

in Cornwall, have met with interest. The following is a typical list of such competitions : 1) A fat steer ; 2) a long wool sheep ; 3) a utility hen ; 4) six roots, either mangolds or swedes and six potatoes ; 5) samples of wheat, barley and oats ; 6) identifying and naming grasses, clover and weed seeds and also naming grass, clover and weed seeds in a mixture of ten species in each case ; 7) identifying and naming grasses, clovers and weeds, 20 species ; 8) naming and valuing foods and manures. In judging the above, students have to take into account appearance and physical characters. The first five cases are judged by points, which are previously discussed and explained to the students.

The Show Committee after consultation with the agricultural organisor and his staff draw up the list of classes, the prizes to be offered, fix a nominal entrance fee and appoint judges. When the competition is finished, the whole is open to the public for inspection. (*Journal of the Ministry of Agriculture*, Vol. XXXI, No. 4, 1924).

1084. **Italy. New Order Concerning the Zoological Station at Naples.** — The *Gazetta Ufficiale*, Nov. 26, 1923, No. 277, publishes the Royal Decree, 21st October 1923, regarding the Station at Naples. This constitutes a transference in full ownership of property situated in Porto d'Ischia, formerly owned by the heirs of Dr. A. DOHRN, and later confiscated by the State under decree No. 470, April 10. The resources and powers of the Zoological Station include — an annual grant from the Ministry of Public Instruction and from the Municipality of Naples ; contributions from private individuals and Italian and foreign Institutes ; arrangement of programmes of work ; entry tax to the Aquarium and other sections.

All the Station's publications will be issued under the Italian cover, but will include sections in the four languages (Italian, French, English, German) used at the International Biological Congress.

1085. **Stock Breeding Experiment Station, Rome.** — According to the decree of February last, the " Istituto Lattifero Agrario " and the " Istituto Zootecnico Laziale ", are now combined to form one experiment station. The funds hitherto paid to the Agricultural Dairy Institute have been transferred to the new stock breeding Institute.

1086. **Oil Research Station of Imperia, Spoleto, and the Experimental " Cantine " of Arezzo and Milazzo.** — The decree of 18th May 1924, includes these Stations under the head of a single independant Institution. Amongst other problems, an opportunity will be given to merchants to make experiments in olive growing and research in oil products ; specialists will be trained in olive cultivation and scientific oil production. Also, the study of vines and grapes relative to vinification, will be undertaken and research on technical questions.

1087. **Rural Schools in Italy.** — Senator FAINA is recognised as the originator of rural schools in Italy. In 1914-15, 20 were established in Umbria under the direction of Dr. FRANCHETTI and 6 more in the following year. The war interrupted this work which was resumed in 1919-20. In Umbria 12 more schools were opened, the number being increased to 30 by 1922 including 2 private schools and one for orphans of the war.

To develop the scheme proposed by the Senator in 1922 the " Ente Na-

zionale per la Scuola Rurale " was formed with the support of the Ministry of National Economy and Education and the Emigration Committee and others. The object is to train children as regards their powers of observation and reflection, but without alienating their interest in rural life.

In addition to the schools of Umbria, others were opened in Calabria and Campania and by 1923 the number reached 50, having 1066 boy and 92 girl pupils, and in the following year, other schools were opened in the Abruzzi and Marche, and in Piedmont, where the scholars numbered about 30 000.

In 1924 the numbers amounted to 97, the pupils being mainly sons of farmers.

Special courses have been arranged at technical institutes and schools of agriculture both elementary and professional, the syllabus including :— *a*) natural history (geology, botany, zoology and hygiene) ; *b*) physics and chemistry with special reference to application on the farm ; *c*) administration, political economy, etc. The course lasts three years ; instruction is given for three hours at a time ; excursions are made and practical work carried out. The course is held simultaneously with the ordinary school session and ends before the harvest. The schools are open to boys and girls of all ages. The schools are well equipped for demonstration purposes.

The technical course lasts two years and includes : agriculture and stock breeding. Fully qualified teachers are employed. A collection of seeds, fertilisers, etc., farm implements and stock, are available for the students.

The results have been very successful and there is a demand for further schools in different parts of Italy ; next year these should number about 300 (*Ente Nazionale per la Scuola Rurale*, pubbl. n. 14. Rome, 1924).

1088 **Course of Industrial Biology at Milan.** — At the suggestion of the " Istituto Sieroterapico Milanese " a course of 10 lessons on biology has been arranged, each of which will consist of theoretical and practical work. The course is intended for graduates in agricultural chemistry and pharmacy, and the heads of industrial concerns.

1089. **Course on Floriculture and Gardening in S. Ilario Liguria (Genoa).** — On the 20th June, 1924 at the " R. Scuola pratica di Agricoltura " Marsano ", a nine months course was instituted for the training of horticulturists, especially for those going to South America, particularly the Argentine. The general Commissioner for Education has instituted this course, which is largely supported by the Ministry of National Economy.

1090. **National Poultry School in Liguria (Genoa).** — At the " Stazione Sperimentale Ligure di Pollicoltura e Conigliocoltura " (poultry and rabbits), a theoretical and practical course has been started. The former includes : anatomy and physiology of fowls ; breeds ; natural and artificial incubation ; feeding ; diseases and hygiene ; statistics of importation and exportation ; study of international progress in aviculture ; by-products ; equipment ; book-keeping.

The practical part includes : poultry runs ; natural and artificial incubation ; rearing ; natural and artificial fattening ; breeding ; preparation of poultry for table ; eggs ; preparation for shows ; diseases ; hygienic measures. The course is strictly practical.

1091. **Switzerland. Report of the Central Experiment Station, Liebefeld, near Berne.** — Part II of the Agricultral Yearbook of Switzerland includes a report of the work of the " Etablissements fédéraux d'essais et d'analyses agricoles " for the years 1920-23.

The work is regulated to a large extent by economists and is largely directed to problems of practical interest. With the collaboration of the various centres, and at the lowest possible cost, it is proposed to take advantage of the practical application of the results obtained by research. It should be noted, however, that it is necessary to make a compromise between the demands and the distribution of public funds, which in recent years has become a difficult matter.

After a general survey of the regulations concerning organisation and central administration, the Report deals in detail with the following fields of activity :

1) General administration and agricultural development. Liebefeld is, as far as conditions will allow, managed as a farm for intensive culture ; the statistics for raw materials obtained there are of special interest to the farmer and are useful for making comparisons.

2) Trade control in agricultural materials. It is in the matter of control that the general public, and particularly the farmer, although interested from the business standpoint, have little knowledge of the working of affairs. The suppression of this service would without doubt have an immediate and a disadvantageous effect on the market, not only for the buyer, but also for trade generally. It will readily be admitted that every one concerned should be in touch with the market prices of agricultural products, and the means by which they are controlled. The data supplied by the reporter gives an insight into the general position and shows the importance of the drawing up at an early date of a federal law for the control of trade in agricultural essentials. It is only by means of such a law that uniformity can be maintained as regards the control of trade in seeds, fertilisers, forage, protective measures, etc., and such regulations are necessary in the interests of the buyer and for the protection of commerce.

3) Experiments and analyses. The aim is to find new methods on an economic basis for agricultural production. In recent years, during the period of stagnation, inventors and those engaged in industry, advertised many novelties on the markets, so that the research stations could with difficulty keep in touch with these new products and also maintain their usual experimental work. As regards crop production, the central administration is carrying out tests in conjunction with other research stations with respect to new fertilisers such as : " exitor agral ", " fertilisa ", " nitragin ", " sinterphosphate A ", and also with a view to the encouragement of the scientific use of non-artificial manures. In addition, comparative crop tests have been made with cereals, potatoes, and other root crops, forage tests including selection of red clover and *Melilotus albus* of American origin.

4) The central administration has continued to show a marked interest in live stock especially the feeding of dairy cows, young stock and pigs. These tests have been made in collaboration with the Agricultural Chemical Station, the Dairy and Bacteriological Institute, Berne, the Institute of Physiology

and the Polytechnical School, Zurich. Feeding tests are carried out on foods such as dried fruits, apples (undried), molasses feeds, tomato cakes, dried turnips, cacao flour, sugar cane molasses, melon pip cakes, and also with silage prepared both by the ordinary and the electric method, and maize silage as made in America. These experiments are often costly, but allow the farmer to obtain a real knowledge of the value of the new products. Of general interest also are the tests on the use of fish meal for pigs, milk substitute for young stock and feeds for dairy cattle.

4) Recent work. A résumé is here given of investigations now in progress showing the contact of the Institute with experts, agricultural organisations and the general public. A list of publications, conferences, and shows is also given (" Bericht der Zentralverwaltung der schweizerischen landwirtschaftlichen Versuchs und Untersuchungsanstalten über die Tatigkeit in der Jahren, 1919:1923 ", compiled by Dr. A. SCHMIDT, Zentralverwalter; Liebefeld, Berne).

Congresses and Conferences.

1092. **Great Britain. International Seed Testing Association.** — The Fourth International Seed Testing Congress was held at Cambridge on the 7th to the 12th July, and included visits to the Rothamsted Experimental Station and the British Empire Exhibition where the Agricultural Section has a distinct educational value. An excursion programme was also arranged from the 14th to the 16th July to enable the delegates to visit the warehouse and seed cleaning plant of the Eastern Counties Farmers' Co-operative Association Ltd., the seed establishment of Messrs Sutton and Sons, Reading, and the Royal Botanic Gardens, Kew.

The Congress was attended by official delegates from the following countries: Argentina, Belgium, Canada, Czecho-Slovakia, Denmark, Egypt, England and Wales, Finland, France, Germany, Greece, Holland, Hungary, Irish Free State, North Ireland, Lithuania, Norway, Poland, Rumania, Russia, Scotland, Sweden, Switzerland and the Ukraine. The International Institute of Agriculture at Rome was also represented, and officials of the United States Department of Agriculture attended.

With one exception the business meetings of the Congress were held at the National Institute of Agricultural Botany, Cambridge. The one exception was the meeting held on Wednesday afternoon, the 9th July, at the School of Agriculture at which a large number of repesentatives of the British seed trade, and of the First International Seed Trade Conference, which was being held at London concurrently with the International Seed Testing Congress, were present.

The Congress was opened on the 7th July by Sir Lawrence Weaver, Chairman of the Council of the National Institute of Agricultural Botany, who welcomed the delegates on behalf of the British Government, the Minister of Agriculture and Fisheries, and the Council of the Institute. The rest of the day and the whole of the 8th, 9th and 10th July were devoted to the reading and discussion of the following papers: — " The Official Seed Testing Station for England and Wales " by Mr A. EASTHAM, Cambridge. Report on the work

of the European Seed Testing Association and the expense connected with this work, by Director K. DORPH-PETERSEN, Copenhagen. Proposal regarding regulations for the European Seed Testing Association, by Director A. VOLKART, Zurich. Uniformity in Seed Testing Reports, by T. ANDERSON, Edinburgh. Determination of the Water Content of Seed, by Dr. Y. BUCHHOLZ, Christiania. " Are not the percentages by weight of the weed seeds, and the names of the species which occur most frequently, to be quoted in each purity determination, and which species must always be counted as weeds ? " by Professor L. BUSSARD, Paris. Report on the work of the Dodder Committee appointed at the Copenhagen Congress by Director Dr. A. V. DEGEN, Budapest. " TheLongevity of Seeds ", by Director A. V. DEGEN, Budapest. " Germination Tests, especially of Clover and Grass Seeds " by Professor Dr. A. VOIGT, Hamburg. " Germination Investigations by Low Temperature ", by Director Dr. W. FRANCK, Wageningen. Report on the determination of provenance established by the Association ,by Director Dr. A. VOLKART, Zurich. " Valuation of Hard Seeds and Determination of Broken Seedlings " by Mr. Edgar BROWN, Washington, and Dr. G. PAMMER, Vienna. Investigations of seeds which are not fully matured, and determination of the germinating power in the soil of such seeds, by Director K. DORPH-PETERSEN, Copenhagen. " Laboratory and field investigations on the purity of strain and investigation of diseases which are transmitted by the seed ", by Director Dr. Fr. CHMELAR, Brunn, and Dr. GENTNER, Munich.

Work of the Association of Official Seed Analysts of North America, by Professor M. T. MUNN, Geneva, N. Y.

A report on the proceedings of the Congress, which will include full copies of the above papers, is in preparation and will be placed on sale by His Majesty's Stationery Office, London at the earliest date possible.

The work of the European Seed Testing Association under the able direction of Director K. DORPH-PETERSEN, in the distribution of seed samples for comparative tests has already been described in an earlier Review (see *International Review of the Science and Practice of Agriculture*, K. DORPH-PETERSEN, European Testing Association, pp. 317-321, 1923). At the Cambridge Congress Director DORPH-PETERSEN indicated the developments which have taken place in this work.

Director Dorph Petersen referred to the arrangements that have been made with the International Institute of Agriculture at Rome to publish articles and papers on work relevant to seed testing. Miss Yeo, at the Chairman's invitation emphasised the importance of centralising information on agricultural subjects at the Institute and drew attention to the forthcoming advantages. Evidence of this was duly noted from the latest monographs and reviews, published copies of which had been sent for the use of Congress members. The Institute has undertaken to reserve about 100 pages each year in the Quarterly Review for reports on seed testing work. Reference is also made in the Constitution of the International Seed Testing Association (see below) to the further developments of co-operation between the Association and the Institute.

Draft Statutes for the Seed Testing Association suggested by Director Dorph-Petersen and Dr. Volkart were discussed at the Congress and a Committee

was set up to prepare a draft Constitution. The following Constitution was subsequently considered and approved by the Congress.

CONSTITUTION OF THE INTERNATIONAL SEED TESTING ASSOCIATION. — 1. *Name and object.* Under the name of the International Seed Testing Association, a union of Official Seed Testing Stations with legal domicile at the residence of its President exists for the purpose of advancing all questions connected with the testing and judgment of seeds. The Association seeks to attain this object through:

(*a*) Comparative tests and other researches directed to achieve more accurate and uniform results than hitherto obtained.

(*b*) The formulation of uniform methods and uniform terms in the analysis of seeds in international trade.

(*c*) The organisation of international congresses attended by representatives of Official Seed Testing Stations for the purpose of mutual deliberation and information, the publication of treatises and reports on seed-testing and mutual assistance in the training of technical officers.

2. *Membership.* The following may be members of the Association:

(*a*) Official Stations which deal entirely or to a considerable extent with seed investigations and are directly controlled by Governments.

(*b*) Similar Official Stations managed by the Institutions or Corporations and effectively controlled by Governments.

(*c*) Associations of official seed analysts.

Each member engages to take active part in the work of the association and each subscribing member receives a free copy of the Association's publications.

3. *Finance.* The income of the Association is derived from:

(*a*) Ordinary annual contributions from its members.

(*b*) Extraordinary revenues.

The amounts of the annual contributions will be approved at each general assembly of the Association for at least the ensuing three years. They will be paid either by

(*c*) A Government on behalf of all the Official Stations in that country, the sum not to exceed fifty pounds sterling per annum.

(*d*) An Official Station or an Institute.

(*e*) An Association of official analysts.

When the contribution is in accordance with clause 3 (*c*) all Official Stations in the contributing country have the right of membership and voting subject to provisions of clause 8. The amount of the contributions will be so fixed that they are sufficient to cover the cost (*f*) of the publications of the Association (*g*) of comparative tests and other researches (*h*) of stationery and clerical assistance.

4. *Meetings, Committees and Administration.* A congress will be summoned by the Association approximately every third year and at the same time the General Assembly of the Association will meet. At this Assembly the following Executive Committee and officers will be elected:—

(*a*) The President.

(*b*) The Vice-President.

(*c*) Not less than three nor more than five ordinary members of the Executive Committee.

(*d*) Two substitute members of that Committee.

(*e*) Two honorary auditors and one substitute who shall not be members of that Committee.

All the foregoing must be technical officers in direct charge of Official Seed Testing Stations.

The General Assembly shall also elect such further Committees as may be necessary for the better ordering of finance, research, publications, etc. All such Committees and officers shall hold office until the next General Assembly of the Association.

The General Assembly will decide as to place and date of future congresses, will nominate as honorary members men who have, by reason of their seed-testing work or their labours on behalf of the Association, especially deserved this distinction.

By resolution of the Executive Committee a General Assembly may be summoned at other times than that of the triennial Congress.

The General Assembly forms a quorum when 10 members with the right of voting are present.

5. *Despatch of business.* The Executive Committee will consist of the President, the Vice-President and its ordinary members. When by reason of death or prolonged inability to serve, an ordinary member is unable to assist in the despatch of business, the President may call upon the services of either or both of the substitute members. The accounts of the Association shall be audited in each year by the two honorary and the audited accounts shall be circulated annually to all members with the Executive Committee's report on the year's work.

The Executive Committee will make decisions as to current expenditure, will elect sub-committeesa and approve the business of the Congress. When the General Assembly is not a quorum the Committee has power to make final decisions on finance and the next place of meeting for the Congress. In case of equal voting on the Committee the President shall have a casting vote.

6. *The President.* The President will preside over the General Assembly and the Executive Committee and at those sessions of the Congress at which important technical resolutions are passed.

He will, as Chairman of the Executive Committee and with the Committees' knowledge and approval, take the initiative in conducting the business of the Association, in intercourse with Governments and other Associations whether of Official Stations and seed analysts or of members of the seed trade. He will arrange, in consultation with representatives of the country where the Congress is to be held, (*a*) the programme of the Congress, (*b*) the proposals for the Chairmanship of the Congress, (*c*) the admission to the Congress of observers and guests. He will summon the meetings of the Executive Committee, will be an ex-officio member of all other Committees and Sub-Committees of the Association and will supervise the publication of the Association's reports.

The President shall have power to appoint a Secretary-Treasurer to assist him, at such remuneration as may be approved by the Executive Committee, and will be responsible for (*a*) the safe custody of the property of the Associa-

tion, (b) the proper disbursement of its funds, (c) submitting to the auditors proper accounts.

7. *The Vice-President.* In the absence of the President from meetings of the General Assembly or the Executive Committee, the Vice-President shall take his place.

8. *Assemblies and Congresses; Delegates and Voting.* Every member of the Association will be entitled to attend the General Assemblies and Congresses. The Executive Committee will before each Congress take into account (a) the contributions of the various coubtries and members and (b) the importance of the work of the Official Stations which they represent, and will determine the number of votes, not exceeding five, to be exercised by the delegates from each country, in voting on the reports of the Committee of the Association. Voting will be by secret ballot, if so demanded, otherwise by show of hands. Resolutions will be carried by a majority of those present and voting. In case of equal voting the President shall have a casting vote.

9. *Voting by Correspondence.* In the event of any important question arising between meetings of the General Assembly, the Executive Committee may refer it on a voting letter to the members of the Association and may act on the decision of the majority of the members who signify their wishes by such written vote.

10. *Withdrawal, Dissolution, etc.* Withdrawal of countries and members can only take place at the end of the calender year and the President must be advised at least three months beforehand of the intention to withdraw.

Dissolution of the Association can only take place when a General Assembly summoned for this purpose shall have voted for it by a three-fourths majority of those present and voting.

Any proposed alterations in this Constitution are to be prepared by the Executive Committee and communicated in writing to the members at least two months before a General Assembly, at which they are to be moved. Resolutions effecting such alterations must be carried by a two-thirds majority of those present and voting.

11. *Relations with the International Institute of Agriculture.* The Association will, in respect of publications and in such other ways as the Executive Committee may find convenient, work in co-operation with the International Institute of Agriculture at Rome. In the event of the dissolution of the Association any assets held by the Association shall be handed over to the International Institute.

After the Constitution had been approved, the Congress proceeded to appoint an Executive Committee, with M. Dorph-Petersen as its President. Committees were also elected to deal with the following matters:— Research for countries with Temperate Climate; Research for countries with Warm Climate; Provenance, determinations; Hard Seeds and Broken Seedlings; Moisture Content and Drying; Investigations of genuineness of Variety and of Plant Diseases: Dodder, Beet; Publications and Registration.

An invitation from the International Institute of Agriculture to hold the next International Congress in Rome, was unanimously and cordially accepted and it was agreed that this should be held during the first half of May 1927.

1093. **Spain. IIⁿᵈ World's Poultry Congress, Barcelona, May, 1924.** — The sections numbered four and were devoted to : 1) research and investigation work on biological and feeding questions ; 2) State aided and voluntary efforts to develop the poultry industry, inclusive of educational work ; 3) hygiene and disease ; 4) national and international trade in eggs and poultry.

Amongst the papers contributed were the following : Future Mendelian investigations (PUNNETT, Cambridge) ; Colour inheritance (GHIGI, Bologna) ; Sex reversal in the domestic fowl (CREW, Edinburgh) ; Gynandromorphism (PEZARD, SAND and GARIDROIT, Paris).

The chief impressions gained from the papers are that : 1) transport difficulties are common to most countries ; 2) diseases of poultry are on the increase and preventive measures are largely used in the United States and continental countries, and restrictions are enforced ; 3) there is a general improvement in all countries in the class of poultry kept and the industry is increasing in value ; 4) schemes for the certifying of breeder's farms, birds, hatcheries and methods of management are being adopted by the Canadian, American, New Zealand and other Governments with systems of inspection and registration ; 5) Holland, Denmark and Cecho-Slovakia are giving special attention to production and co-operative marketing.

The following resolutions were adopted :— *a*) That it is desirable that aviculture research institutes, similar to that described in the report of H. E. DALE of London, should be established in all countries ; *b*) that it is desirable that the measures adopted by the Italian Government should be initiated everywhere where the need is felt, by means of the creation of avicultural Research Stations in existing agricultural institutes ; *c*) that it is desirable that uniform examination rules should be fixed by international convention for the international and national egg trade ; *d*) 1) that the standards of the country of origin should be communicated to the respective federations and associations of all countries ; 2) that the various breeds to be judged at exhibitions should be defined with greater precision by measurements of different parts of the body and by a statement of size and weig ht, and to establish a Committee. (Rejected). *e*) that an International Federation of Aviculture should be constituted (left to Societies) ; *f*) that the Ministries of Agriculture, railways and Customs of the different countries should get into touch to arrange : 1) that a uniform tariff be fixed for the delivery and return of exhibits ; 2) that the documents to accompany consignments should be simplified and standardised ; 3) that the Customs formalities should be simplified ; 4) that the Customs formalities should be carried out on exhibition premises ; 5) that the certificate of the Committee and veterinary officer should be accepted on return for passing the frontier.

In the section of hygiene and disease the following speakers took part : MM. TRUCHS and STAUD of the Pasteur Institute, Paris, LANFRANCHI and SABI of Bologna, HENEPPE of Rotterdam, LEYNEN of Belgium, BRUMPT of Paris, PANISSET and VERGE of Alfort, and HARING of California. The subjects included : vaccination against cholera, typhoid and diphtheria ; tuberculosis by the method of intradermoreaction, the control of mycosis, mites, argasidae, and helminthidae. The ethnographic papers include : the Catalan breed (ROSSELL y VILA), the Chile breed, with blue eggs (CASTELLO, Barcelona).

In section 4 is included reports on production in Czecho-Slovakia, France, Italy, England, Denmark, United States, Holland, Spain, India, New Zealand and Burma.

An International Poultry Exhibition was held simultaneously. (*Revue de Zootechnie*, Year 3, No. 7, Paris, 1924).

1094. **Egypt. International Geographical Congress, Cairo, April, 1925.** — On the initiative of H. M. THE KING OF EGYPT and under the Presidency of S. E. ADLEY PASHA YEGHEN, the above Congress will meet in Cairo, probably from the 2-12 April 1925. The programme includes VIII sections, covering the various aspects of scientific and commercial geography, and also agriculture and irrigation. The official languages of the Congress will be Arabic, English, Italian and French.

In addition to the Meetings, excursions will be arranged to Aswan, the Gulf of Suez and the Red Sea. Comunications should be addressed to the General Secretary, Organisation Committee, Royal Geographical Society of Egypt, 45 rue Cheikh Youssif, Cairo.

1095. **United Statés. International Botanical Congress, Ithica, N. Y. 32 June to 1 July 1924.** — For information apply to the Secretary, Botanical Gardens, St. Louis, Missouri.

1096. **France. IV International Congress fot the Middle Classes, Paris, 2-4 June 1924.** — Subjects dealt with at the Congress: — Social duties of the intellectual world towards the middle classes (Prof. FLORIANI, Milan); Professional Internationalism and internal affairs (SCHWIEDLAND, Vienna); Means for the development and improvement of the middle class peasants (VUIGNIER, Paris); The peasants and agrarian reform in Czecho-Slovakia (VISKOVSKY, Prague); Housing problems of the middle classes (MANOILESCU, Bucharest). For information apply to M. DUFOURMENTELLE, 05 Avenue Kleber Paris (16).

1097. **Italy. IIIrd Annual Meeting of the "Sylva Mediterranea" Florence, 27-31 May, 1924.** - The International Forestry League for Mediterranean Countries was formed with a view to the study of sylvicultural problems in the Mediterranean coastal regions. At the Meeting the chief discussions dealt with the reafforestation of calcareous districts. The following papers were read: — On the planting of certain exotic resinous trees on calcareous lands (LICKEL); Reafforestation in Sardinia (ALLEGRETTI); The reafforestation of mountain areas according to botanical distribution (GUINIER); Characteristics of sylviculture in the Mediterranean regions (MERENDT); Elimination of undergrowth and reafforestation in arid zones (PAVARI); Reafforestation of Monte Cesane near Urbino (FERRARI).

Visits were made to the reafforested districts on Monte Mercilo near Florence, the pine forests of Duke Salviati at Migliarino, near Pisa, and also to the forest of Vallombrosa, formerly the headquarters of the School of Forestry.

For information apply to Prof. PAVARI, R. Istituto Superiore Forestale, Florence.

1098. **International Refrigeration Conference, Rome, Spring, 1927.**

1099. **Poland. XIII. International Agricultural Congress, Warsaw.** — At the International Commission of Agriculture, Paris, July, 1924, it was decided at the suggestion of Dr. LUTOSLAWSKI, supported by Prof. Mori (Italy) that the next Congress should be held at Warsaw, probably in September,

1025. The organisation will be arranged by the same Commission which met in London at the Ministry of Agriculture.

1100. **Germany. Colonial Congress in Berlin, 17-18th September, 1924.** — The work of the past 40 years was discussed being divided into six sections: political; economics; tropical medicine and hygiene; missions, schools and communal problems; colonisation; geography and ethnology and natural sciences. Hon. President, Archduke Adolph Frederic of Mecklenburg; President, Dr. Seitz, President of the German Colonial Society.

1101. **Argentine. Historical-Geographical Congress in Buenos Aires, 12 October, 1924.** — This Congress was held in conjunction with an exhibition of laboratory and scholastic equipment, litographic apparatus, radiography, photography, etc. The Congress and Exhibition were under the patronage of the President of the Republic and the Ministry of Education for Argentina.

For information apply to the Secretary of the Congress, Calle Reconquista, Buenos Aires.

1102. **Brazilian Congress concerning Oleaginous Products, Fats and Resins. Rio de Janeiro, 7-12 September, 1924.** — The "Sociedade Brasileira de Chimica" has supported this Congress, to encourage scientific and industrial progress in reference to oil products, fats, waxes, resins and other substances of native origin. The Congress was under the patronage of the Ministry of Agriculture, Dr. Miguel Calmon, of the above Society and of the Club de Engenharia. There were three sections: 1) (*Agriculture*) Agriculture in the State, botanical classification, cultivation, soils, manures, climates, cost of production, yield, export, import, injurious insects, improved methods, economic and scientific improvements, profits. 2) (*Scientific*) Formation of fats in plants, classification of oil plants, percentage of oil products in plants, Brazilian vegetable oils from the chemical and pharmaceutical standpoint, digestibility, extraction, refining, waxing and elimination of odours from fats, waxes and resins, adulteration and fraud, systematic and chemical analyses, classification and terminology, oils as foods, fuel and lubricants, biological study of vegetable fats; 3) (*Industrial and commercial*). Fats, waxes and glycerine, soaps, etc. study and preparation of raw materials, extraction, refining, elimination of odours, oil products as feeds, medicines, fuel and lubricants. Oil cakes for stock and the utilisation of fats, waxes and resins in the various industries, value of castor oil by-products, machinery in Brazil, advantages and disadvantages of gas, petrol, electricity etc., in industry, organisation of industrial work, hygiene, hydrogenation of vegetable oils, classification of products from the commercial and industrial standpoint, legislation, agriculture, industry and trade in Brazil, standardisation of industry insurance of factories for linters, oil cake, flour, soap, glycerine, stearine, etc.; export and import tariffs, transport and its improvement, protective tariffs, standardisation of transport home and foreign; advertisement, economic classification of waxes, resins and fats.

Contemporaneously with the Congress a Machinery Exhibition was held.

1103. **Spain. XVth Forestry Congress in Valence.** — Several important conclusions have been arrived at respecting the protection of national forests. A Forest Commission was nominated and empowered to take the necessary steps to carry out the improvements. These decisions should lead

to useful legislative and technical measures, for instance : *a*) national territory might be divided amongst the farmers as forests and pasture ; *b*) the forest zone should include all territory which cannot be permanently and economically cultivated, but which may be suitable for woodland areas.

At present the first requirement is to make a full list of the protected woodlands, in which should be included all territory already marked for afforestation, as stated in Art. 1 of the Decree, 24th June, 1908. The catalogue should specify the water basins, beginning with the most important. All such territory should be under the control of the forestry administration, with the object of obtaining and keeping up a good quality stand. It is important to reserve a sufficient area of coppice land, also to reserve as much land as possible for pastures, to allow of the upkeep of stock in a given locality. Any other areas of such public territory should be reserved for the " Ente propietario " so that it may be turned to the best account by the State, which is responsible for forest protection and for the supply of wood in the country. After the lapse of fifty years, reafforestation should have been carried out to the extent of 1 million hectares.

The inclusion of territory in the aforesaid catalogue tends to bring such territory under public control, and in case of expropriation of a proprietor who not being willing to accept the given terms, offers means of meeting the difficulty. The cost of reafforestation will eventually be met by the " Ente propietario " by means of a re-imboursement. To facilitate the execution of further improvements, it is proposed by the " Director General de Agricultura y Montes " to establish a " Caja Forestal Central " with an adequate fund to deal with the existing situation in a satisfactory manner. (*España Forestal*, Year X, No. 98, 1924).

1104. **United Statés. Forest Service Research Conference, Madison, Wionsin.** – At this Congress held recently three general subjects were considered — 1) re-search results in the study of forest fires, their control, prevention and prediction ; 2) the technique of measuring and estimating the growth and yield of timber of various types under the widely varying forest conditions in the different sections of the country ; 3) the standards of forest practice for the various regions, which are necessary to keep forest lands productive. This subject was considered from two standpoints, representing different levels of attainment : *a*) the minimum requirements in forest practice which are necessary to prevent forest devastation ; *b*) desirable forestry practice, a standard now prevailing on the National Forests because of their being under the control of the Forest Service. (*Science*, Vol. LIX, No. 1539, June, 1924).

1105. **Second National Symposium of Colloids, Chicago, 18-21 June 1924.** — The 1925 the Congress will be held at the University of Minnesota.

1106. **Meeting of the American Society for Advancement of Science, 23 December 1924 to 3 January, 1925 at Washington, D. C.**

1107. **XX Meeting of the American Society of Horticultural Science Cincinnati, 27-29 December, 1924.**

1108. **XXXIX Meeting of the American Chemical Society, Washingon. 19-21, November, 1924.**

1109. **France. Congress of the Federal Vinegrowers Association, Dijon. 18-19th June, 1924.** — The chief decisions taken included a protest against

the Customs regulations in force between France and Tunis and between Tunisia and Algeria ; equal protection of agriculture and industries, and the increase of protection against foreign wines ; rigorous application of regulations concerning wines sold without guarantee of origin ; authorisation of the Ministry of Agriculture, similar to that of the Board of Trade, for claiming additional taxes, sugaring of wines up to the maximum of 250 kg. per hectolitre ; suppression of sugaring in the case of secondary wines and those of inferior quality.

1110. **Potato Congress, Limoges, 6th June, 1924.** — Subjects discussed :— Methods of increasing yield (HILTIER, Institut National Agronomique) ; Methods of improving the potato trade, selection, packing, marketing (POHER) ; Improvements carried out in Holland on crossing and selection, and the support of the Dutch Government (SEVENSTER, Agricultural adviser, Holland) ; Improved varieties of tubers (MOTTET, Vilmorin establishment) ; Causes of degeneration of potatoes (FOEX, Director of the Phytopathological Station at Paris) ; Methods of seed selection (DUCOMET, School of Agriculture, Grignon) ; Diseases of potatoes and cupric treatement (FRON, Institut National Agronomique) ; Damage caused by Doryphora (FEYTEAU) ; Control of Doryphora) (BACON, Director of the Agricultural Service of Dordogne) ; Cultivation of out of season potatoes (BUSSARD, Asst. Director of the Seed Station, Paris) ; Large scale conservation of potatoes (DESSALES, Director of the Agricultural Service, Haute-Vienne) ; Cold Storage of potatoes (SIGMANN) ; The drying of tubers (LEMONNIER) ; On the starch of potatoes (NOTTIN) ; Improvement of implements for manual work (COUPAN).

1111. **Congrés des étangs, Paris, 14-15 February, 1924.** — Under the auspices of the Paris-Orleans Railway, interest has been aroused in the productivity of te fish ponds of Sologne. At the Congress, Prof. ROULE made an interesting communication respecting the progress effected in the breeding of carp. M. GALLOIS, Conservateur des Eaux et Forêts, has experimented on the breeding at Fîmes of indigenous carp. Prof. LEGER discussed the feeding of pond-fish in relation to yield, and the classification of ponds according to the quantity of plankton contained per cubic metre. M. GUENAUD dealt with production from the standpoint of railway transport. (*Comptes rendus des séances de l'Académie d'Agriculture de France*, Vol. X, No. 17).

1112. **Cider Week in France, May, 1923.** — Report of M. LINDET at the meeting held on the 2nd April, 1924. The Congress was divided into four sections : 1) pomology, upkeep of orchards, new plantations, adaptation of apple trees according to district, diseases and pests ; 2) quality of ciders, improvement, selection of ferments, use of low temperatures, concentration of musts, clarification of cider, control, etc. ; 3) industries other than cider, such as alcohol and vinegar manufacture ; 4) legislation respecting ordinary and concentrated cider, place of origin, transport and trade in ciders and perry. (*Comptes rendus des séances de l'Académie d'Agriculture de France*, Vol. X, No. 12, 1924).

1113. **Report of the IIIrd Congress of the Chemical Industry held at Paris, 21-26 October 1923, (50fcs).** — For information apply to the Société de Chimie Industrielle, rue de Mathurins, Paris (8).

1114. **Decisions of the Stock Breeding Congress in France relative to Herdbooks of French Breeds : Paris, 7-8 May, 1924.** — Under the auspices

of the Société nationale d'Encouragement Agricole of the 8 agricultural districts, and the French stock breeding headquarters. The publication includes: history of pedigree books, by DECHAMBRE; rules of organisation and upkeep of herdbooks, by VOITELLIER; examples of modern methods of recording breeds, by LAPLAUD; identification of stock and control of offspring, by PRÉVOT and LEROY. A monograph has been produced, price 30 francs, and is sold by the Société, 51 Avenue de l'Opéra, Paris (51).

1115. **Fat Stock Show at Antananarivo, 17-23 September, 1923.** — The following classes of animals were included: solipede animals; butchers' beasts; fat cattle; bulls and cows of milk breeds; fat pigs and pigs for breeding; poultry. The horse show is divided into sections: Class 1: stallions and adult mares of three years and over, for saddle and draft purposes, divided into 3 groups: *a*) ponies up to 1.45 metres; *b*) horses from 1.45 to 1.50 metres; *c*) horses of 1.50 metres and over. Class 2 consisted of a competition for crossbreds from native mares and Breton stallions; Class 3 was reserved for asses. The butchers' beasts included the so-called "bœufs d'herbe", namely animals fattened entirely on natural pasture. Class 3 included fat oxen of the "bœufs de fosse" type, that is those fattened in a confined area and given supplementary feed. Stock thus treated fetch double the price of those fed on grass. Pigs were divided into three classes: fattened; sows; boars.

Full details have been published by M. GEOFFROY in the *Bulletin Économique de Madagascar*, Parts 2-4, 1923.

1116. **Scottish Cattle Breeding Conference, Edinburgh, 7-12, July, 1924.** — The subjects discussed were: Origin of cattle (Prof. J. COSSAR EWART, University of Edinburgh); Notes on the history of stock breeding and the formation of breeds (Prof. Jas. WILSON, Dublin); Relation between genetics and practical cattle breeding (E. N. WENTWORTH, Director of Armour's Livestock Bureau, Chicago); Genetics of cattle inheritance (Dr. L. J. COLE, Chief of Animal Husbandry Division of the U. S. Bureau of Animal Industry); The inheritance of black and red coat colour in cattle (M. K. CAMPBELL, University of Illinois); Inheritance in Scottish breeds (Prof. J. SCOTT WATSON, University of Edinburgh); The reproductive functions in the cow (J. HAMMOND, Animal Nutrition Institute, Cambridge); The present state of our knowledge of sex in cattle (Dr. F. A. E. CREW, Director of the Animal Breeding Research Department, Edinburgh); Breeding by type, pedigree and progeny performance (Dr. L. J. COLE); Families and line breeding (Prof. J. SCOTT WATSON); Prepotency in character transmission (E. N. WENTWORTH); On genetics (Dr. RAYMOND PEARL, Professor of Vital Statistics, John Hopkins University, Baltimore); Shorthorn breeding in America (W. A. COCHEL, Field Representative, American Shorthorn Breeders Association); Interpretation of milk records (H. G. SANDERS, Cambridge); The need for a uniform system of stating milk and butter fat (J. MACKINTOSH, National Institute for Research in Dairying, Reading); Inbreeding and outbreeding (Dr. L. J. COLE); Failures in cattle breeding (Prof. J. COSSAR EWART); Shorthorn breeding problems (W. F. MCLAREN, Naemoor Estates, Runnibing Bridge, Scotland); Problems in breeding, selection, breed improvement methods, etc. (Dr. G. F. FINLAY, Animal Breeding Research Department, Edinburgh); Character correlation in cattle breeding (E. N. WENTWORTH); Calculation and statement of progeny

records of bulls (J. MACKINTOSH) ; The development of the udder in the cow (J. HAMMOND) ; Symposium on cattle hybridisation (R. S. HAMER, Chief of Cattle Division, Department of Agriculture, Canada) ; Effect of fairs and markets in determinating cattle types (E. N. WENTWORTH) ; Revie of cattle breeding experiments (GRAVES, COLE, GOWAN and YAPP). The outlook for constructive cattle breeding (Dr. L. J. COLE) ; Perpetuating a great family of Jerseys (Prof. H. VAN PELT, Iowa) ; Vigour in cattle (H. G. REGNART, Albury) ; Cattle situation and prospects in the British Empire and various countries (Dr. E. W. SHANAHAN, London School of Economics) Review of the cattle situation in the chief cattle countries of the world. (*Farmer and Stock-Breeder*, Vol. XXXVII, No. 1813, June, 1924).

1117. **Mycological Conference, London.** — A conference of mycologists organised by the Imperial Bureau of Mycology, was held in London during the first week of July, 1924. The subjects discussed were :— 1) activities and organisation of the Bureau ; 2) publications of the Bureau ; 3) coordination of investigations on fungicides ; 4) plant diseases ; survey in the Empire ; 5) standardisation of popular and scientific nomenclature in plant pathology ; 6) encouragement of industrial enterprise in the investigation of plant diseases ; 7) diseases of tropical crops ; 8) influence of soil conditions on plant diseases ; 9) practical application of the results of mycological investigations.

It was resolved to recommend that a similar conference be held in five years' time. (*Tropical Agriculturist*, Vol. I, No. 9, Trinidad, 1924).

1118. **Meeting of the British Association, Toronto, August, 1924.**

1119. **First Plant Breeders Conference, India, 14 April, 1924.** — The Conference was held at the College of Agriculture, Poona, under the Presidency of Dr. W. BURNS. It was decided to hold the Conference each year and the next will take place at Surat.

1120. **Italy. National Congress of Chemical Industry, Milan, 13-18 April,1924.** — In the section of Agricultural Chemistry, Agricultural Industries and Foods, the following subjects were discussed : Vinification of " barbaresco " with selected ferments (Dr. MENSIO, Canelli) ; Problems of alcoholic fermentation according to recent research on alcoholic zymases (Prof. PARIS, Perugia) ; Italian turpentine (Prof. PALAZZO, Florence) ; Factors influencing alkaloid production in plants (Dr. RAVENNA, Pisa) ; Contributions to soil sterilisation (Dr. G. ROSSI, Milan) ; Concentration of tomato juice in vacuo (Prof. MONTE, Turin) ; The new De Vecchis method for sugar manufacture (Dr. SANI, Rome) ; The action of ultra-violet rays on alcoholic fermentation and on yeast (Dr. FAZI, Rome) ; Calcium sulphate refuse as a substitute for straw litter in stalls (Prof. MILESE, Torino) ; Ammonia synthesis (G. CLAUDE, Paris) ; Old and new fertilisers (Prof. MENOZZI, Milan) ; Production and consumption of fertilisers in Italy (MORANDI, Piacenza) ; Directions for fertilising land (PRATOLONGO, Milan) ; The synthetic ammonia industry in Italy (EAUSER, Novara). Leucite as a fertiliser and methods foi the use of leucite as a source of aluminium potassium silicate (BLANC, Rome) ; Possibility of obtaining potassium from volcanic rocks in Italy (G. ROSSI, Rome).

For information apply to the Secretary of the " Società di Chimica Industriale ", Via San Paolo, 10, Milan.

1121. **Stock Breeding Congress, Rome, 17-18 March, 1924.** — Subjects discussed: Preparation for improvement of Italian breeds of sheep (ROMOLETTI). It is proposed to give attention to pasture lands, sheep-runs, technical instruction of shepherds, prophylactic measures respecting diseases, and the adoption of a scheme for breeding and selection; classification of wool in Italy (SANSONI); classification is considered necessary in the interests of the trade. Production and trade in sheep-cheese (DEL GRANDE). A decree has been issued stating that a uniform marking be adopted throughout the kingdom for cheese made from sheeps' milk; distinctive marks may be used by manufacturers. The "Ente" has the legal right to control such cheese provided that such control is carried out by qualified persons unconnected with the "Ente".

The Congress laid stress on the advisability of founding a National Institute of Breeding.

1122. **XII Meeting of the Italian Society for the Advancement of Science, Naples, 28 April-3 May, 1924.** — For information apply to Istituto di Fisica della R. Università, Via Antonio Tari, No. 3, Naples.

1123. **National Convention for Legislation on the Water Supply in Italy, Milan, 24 October, 1924.** — Subjects discussed: Systems of water supply; lakes and artificial reservoirs; drainage, irrigation and drinking waters; hydraulic power, internal navigation.

1124. **Russia. Conference of Trusts for Exportation of Timber.** — Before the war the timber trade of Russia, including Finland, amounted to 32 % of the world's production. This has now been reduced to 6-7 %. It is hoped in the future to restore the industry to its pre-war status. The Conference arrived at the following conclusions: *a*) necessity to increase exports; *b*) necessity of more capital for the timber trade; *c*) necessity of regulation of production with a view to decrease of cost; *d*) necessity to establish a group of brokers who will be held responsible for the control of exports, in order to avoid any false use of trade marks; *e*) necessity to establish an order concerning the export of timber from the northern areas.

These measures should tend to stabilise the trade, and should be acceptable in central Europe. In this way, Norway, Sweden, Finland and Russia would control more than 50 % of the world's export, and more than 60 % in Europe, and the adoption of such measures would enable reasonable prices to be maintained. (Лесопромышленное дело, Nos. 3-4, p. 7-8, 1924).

Exhibitions, Fairs and Shows.

1125. **International Exhibition of Dairy Machinery and Refrigerators, Buenos Aires, 1 September, 1924.**

1126. **International Exhibition of Hydro-Electric Apparatus; Grenoble (France) May-October, 1925.**

1127. **International Fair in the Dutch Indies, Bandoeng, 21 June-4 July, 1924.**

1128. **Ist Official Colonial Fair, Antwerp, September, 1924.**

1129. **Agricultural and Stock Breeding Show, Liège (Belgium), June, 1924,** held in connection with the Société Royale de l'est de la Belgique.

under the patronage of H. M. the King. Entries were open to horses, cattle, pigs, dogs, poultry, agricultural products, flowers, machinery, and implements.

1130. **Ist Commercial Fair, Ostend, (Belgium) 5-27 July, 1924.**

1131. **Exhibition of Electrical Appliances, Ghent (Belgium), July-September 1924.**

1132. **National Exhibition, Nantes, May-October, 1924.**

1133. **Agricultural Exhibit at the British Empire Exhibition, 1924.** — This exhibit is confined to research and education, and is an attempt to summarize the work of the research institutions and laboratories in Great Britain. It should be noted that these institutions are not necessarily under State control and are frequently independent organisations with their own governing bodies, quite apart from the State, and are the result of individual enterprise and supported by private means. The State, however, contributes to financial support and collaborates as far as possible (e. g. Rothamsted Experimental Station). Thanks to the creation of the Development Fund under which a sum of money is set aside annually by Parliament for the development of agriculture and rural industries, reclamation and drainage of land, harbours and fisheries, the framing of a general policy of agricultural research, allotted to specially equipped institutions, has been facilitated and there are few agricultural problems which are not receiving the closest attention as is also the training of research workers. The exhibits show the various branches of work covered.

1. *Soil.* — A variety of exhibits relative to soil structure; three important phases of soil cultivation; the action of the plough on the furrow slice; the mechanism of the dynamometer, i. e., the recorder of the draw-bar pull, the speed of ploughing and the depth of ploughing. It is possible to calculate the differences in power consumption brought about by different soils and manures, and also the variations due to shape of plough, speed of ploughing, etc.

2. *Improvement of plants.* — This includes plant breeding as applied to cereals, grasses, potatoes, and fruits, and also seed testing. For wheat breeding, special attention is given to the combination of a heavy yielding capacity, a good baking quality, and resistance to rust, and for improved varieties of oats, to hardiness and superior quality of grain and straw, high yield and early ripening, isolation of pure lines for hybridisation and inheritance of ear types. In the case of fruit trees, methods are studied in control by means of selection and standardisation of the roots, effect of stocks, etc.

3. *Diseases and insect pests and methods of control*, with special reference to wart disease of potatoes, silver leaf (*Stereum purpureum*), gooseberry mildew (*Sphaerotheca mors-uvae*), worms, diseases of potatoes, tomato diseases and pests, eelworms, aphides and the tsetse fly.

4. *Model allotment garden:* the cropping of an ordinary 10 rod allotment.

5. *Machinery and implements:* illustrating the mechanical power required for field operations, the lay out of farm buildings and the use of electricity on the farm.

6. *Animal breeding.* — Sex-linked inheritance in poultry and in goats; improvement of sheep for production of wool and mutton.

7. *Milk production*, illustrating amongst other things :— the effect of excessive acidity and alkalinity on the colour-producing properties of micro-organisms responsible for the frequent discoloration of cheeses and the damage done

by cheese mites and the means of control; a model dairy and the processes of cooling, bottling and pasteurisation in operation.

k. Feeding of animals; including metabolism experiments on pigs and the energy requirements of animals, the effect of work, etc.

o. Diseases of animals and their control, including bacterial diseases, louping ill and dysentry investigations, virus diseases, tumours, parasitic diseases, effect of poisonous plants.

to. Farm accounting; methods recommended to be employed. The charts illustrate the influence of prices on cereal growing and the influence of the individual crop on the total arable area; how the size of the farm influences the nature of the business carried on, and the efficiency of organisation.

Cinematograph films dealing with agricultural machinery, clean milk, sugar beet and improved varieties of wheat, have been shown regularly.

1134. **National Exhibition, Toronto, 23 August-8 September, 1924.**

1135. **National Exhibition of Pure and Applied Chemistry, Turin, September-October, 1924.**

1136. **Exhibition of Inventions at the IVth Industrial Fair, Naples, 16-30 September, 1924.** For information apply to IV Fiera Campionaria, Via degli Acquari, Naples and to "Delegato della Galleria delle Invenzioni" A. GIAMBROCONO, Via Medina, 78, Naples.

1137. **National Exhibition of Typical Italian Wines, Casalmonferrato, 20 August-15 September, 1924.**

1138. **IIIrd Agricultural and Industrial Exhibition, Kovno, Lithuania, 22 August-1 September, 1924.** — Sections include stock, implements, skins, and hides, textiles, chemicals, and foods.

1139. **XIth Dutch Fair, Utrecht, 9-18 September, 1924.**

Miscellaneous.

1140. **International Cheese Convention.** — A Congress was called to discuss matters concerning the fat content and terminology of cheeses. At the World's Dairy Congress at Washington, October, 1923, views were expressed by Denmark, Sweden, Norway, Holland and Switzerland but no decision was arrived at. On the proposal of Prof. Peter (Switzerland), it was decided to recommend the formation of an International Committee to co-ordinate the resolutions adopted by the various countries. At the request of Dr. SWAVINK (Holland), several States were invited to nominate delegates for the development of this question. Different views are held respecting the required percentage of fat in cheese: America requires a minimum of 50 % on dry material; Switzerland a maximum of 45 %, while Holland considers 40 % sufficient. Probably 45 % might be agreed upon.

Nomenclature has caused considerable difficulty. At the World's Dairy Congress it was proposed that names referring to specialities should be adopted only in cases of real originality and imitation products should bear the name of the country of manufacture. For example: "Emmenthal" should refer solely to the genuine Swiss product, and "Gouda" to the genuine Dutch product and "Roquefort" to the French cheese. Imitations should be named as follows: "Emmenthal Finlandese", "Gouda Danish", "Roquefort Swiss". A gen-

position was made by France, viz., the determination of origin should be reserved solely for the genuine products and all imitations should be given a nomenclature quite distinct from the original products. (*Molkerei Zeitung*, Hildenheim, 1 May, 1924).

1141. **The State Vineyards, in the Rhine Provinces.** — The renovated vineyards in the Rhine Valley are State property and are of great interest, showing the extent to which efforts have been concentrated on wine production in the northern States. These include :

1) Rheingau, Hochheim, Etville, Rauental, Graftenberg, the ancient convent of Eberbach which collects the grapes of Steinberg, Marcibrunn and Haffenheim, the slopes of Rudesheim and the vineyards of Assmanhausen, an area of about 100 hectares.

2) The Hesse-Nassau Rhine, Nacknheim, Bodenheim, Nierstein, Oppenheim, Bingen, Budesheim, and Bergitrasse an area of about 50 hectares. The chief vintage station is situated at Mayence.

3) Valley of the Nahe ; Niederhausen (25 hectares).

4) Valley of the Moselle and Sarre ; vineyards of Avelsbach, (28 hectares) of Okfen (14 ha.), of Serrig (30 ha). The central " cantine " is situated at Trier. M. BIRON who has supplied the above information will shortly publish an article with illustrations, showing the characteristics of these vineyards, and the wines. (*Le progrès agricole et viticole*, Year 41, No. 27, 1924).

1142. **Heinrich Herz Association.** — This association was founded at Hamburg, the birth place of the well-known physicist Prof. WOLFF, Rector of the Hamburg University ; and the aim of the Association is intermediary between scientific research and practical application.

1143. **New German Dairy Periodical.** — This is the outcome of a previous publication issued by the Deutscher Milchwirtschaftlicher Reichsverband which deals with investigations on the milk industry. Dr. W. GRIMMER, under Government direction, has initiated a new journal, the *Milchwirtschaftlicher-forschungen* (I. SPRINGER, Berlin), which contains contributions from the leading investigators.

1144. **German Vine Growers and Insecticides.** — With the present money values in Germany, vine growers, who in 1923 had to sell a large part of their products for corresponding paper money, found that in 1924 they lacked the means to purchase insecticides. As the Government did not allow them any assistance, the firm of E. MARK of Darmstadt gave the vine growers credit at a low rate of interest until the vintage season at the end of October, and gave them adequate supplies of insecticide.

1145. **Agricultural Inspection in Brazil.** — Director A. TORRES, Service of Agricultural Inspection, has published an article describing the Services under his charge. The chapters include modifications subsequent to the Ministerial Order, 1909-1922 ; economic situation in Brazil compared with other nations ; agricultural inspection ; Congress of agricultural inspectors ; hundredth international exhibition ; yields ; fertilisers and manures ; seeds and plants ; co-operation ; credit ; maps, ; farming materials ; collaboration of inspection services with other services ; foreign trade of each State ; work of the secretaries of the inspection services ; numerous figures and diagrams are included. The inspectors have to report on existing conditions and requirements throughout

the country and should keep the central administration informed as to methods of cultivation, and yield and give advice to farmers.

More than 80 enquiries have already been dealt with on technical, economic and social questions, in a single municipality.

Investigations have been made on cotton, sugar cane, coffee, maize, beans, maté, cocoa, coconut palm, carnauba, wheat, potatoes, etc. In September 1921 Brazilian inspectors held a Congress in Rio de Janeiro to discuss improvement in the inspection service. As a means of estimating the yield, data have been prepared to show the commencement and the duration of harvest of the chief crops in Brazil. It is shown that coffee is harvested in April in Spirito Santo, in Rio and Minas Geraes in May, in San Paolo and Goyaz in June, in Parana in July, in San Paolo, Goyaz, Parana, Parayba, Pernambuco, Alagoas, Bahia and Santa Catherina in August, and also in Ceará; in September the harvest is ended in Parana but still continues in the other six States, and is only beginning in Acre; in October it is only taking place in Ceará and Acre, and in November in Acre alone.

Sugar cane: in Pará, Sergipe in January; in February, *nil*; in Rio Grande do Sul in March and April; in Matto Grosso, Spirito Santo, Rio de Janeiro, Rio Grande do Sul and Minas Geraes in May; in Piauhy, Spirito Santo, Rio de Janeiro, Minas Geraes, Acre, San Paolo, Paranà, Matto Grosso and Goyaz in June; July, as for June, with the addition of Maranão and Rio Grande do Norte, Santa Catherina and Rio Grande do Sul; August ended in Minas Geraes and Acre and begun in Ceará; in September, begun in Céará ended in Piauhy, Paranà, and Matto Grosso and begun in Pernambuco, Amazonas, Bahia, Allagoas, Parahyba; in October, ended in Rio Grande do Norte, Santa Catherina, Rio Grande do Sul and Matto Grosso and begun in Sergipe; in November, ended in Céará, Spirito Santo, Rio do Janeiro, San Paolo, and begun in Pará; in December, Pará and Sergipe.

Rice, beans and maize are harvested throughout the year; wheat in December, January, and February in Paranà and Santa Catherina, Rio Grande do Sul and the State of San Paolo from September to November.

The following are some of the products; brandy, alcohol, potatoes, maté cotton, sugar, wheat, rye, rice, wine, rubber, cacao, coconut, coffee, manioc flour, beans, maize and tobacco.

The cultivated area occupies about 10 million hectares. The application of fertilisers is limited to the State of San Paolo on coffee plantations and in Rio Grande do Sul in the case of rice.

The water and mineral power of Brazil are immense, the latter including apatite, potassium nitrate, guano and calcareous deposits. Six factories are engaged in the manufacture of fertilisers from oil residues from "xarque" (meat, salted and dried) and from frozen products. Use is made of castor oil cakes, cotton meal, bone ash, blood, horns, ash, lime, gypsum, superphosphate, etc.

There are five Seed Stations:—"Fazenda de Sementes" (State of Rio de Janeiro), was founded subsequent to the law, No. 2738, Jan 1913. Here the more important seed selection work is carried out. The Chemical Branch of the Ministry had analysed by the end of 1921, 1071 samples of seed of various species. Hence, comparisons are possible with species from North America and

Europe. Brazilian maize, rice and leguminous seeds have a high protein content and are somewhat low in nitrogen-free extracts.

The inspection service has been entrusted with the preparation of agro-geological, agricultural, and forestry maps of Brazil. In the first place, economic maps are being prepared ; the Institute of Chemistry has already made analyses of 1024 soil samples in connection with this work, the composition of which samples is given in tabular form.

The geographical map section has prepared agricultural maps for 15 States. Report presented by Dr. MIGUEL CALMON DU PIN and ALMEDA, Minister of Agriculture, Industry and Commerce, for A. TORRES, Jun. Director of the Inspection Service. ("Fomento agricola". Rio de Janeiro, *Imprensa Nacional*, p. 250, with maps and tables, 1924).

1146. **Cultivation of Wheat in the State of Bahia, Brazil.** — Progress has been made chiefly in the municipality of Jacobina. The Director of the "Molino Inglez" of Bahia has reported on the excellent quality of wheat produced in the State and its capacity for making good bread. (*Fazenda moderna*, Year IX, Nos. 2-3, 1924).

1147. **Report of Scientific Botanic Expedition on the Amazon.** — The expedition was accompanied by the well known scientist Gerard KUHLMAN who made the following observations. The flora of the Amazon is very rich and interesting, both from the botanical and practical standpoints. Amongst the species found are included 70 varieties of fruit and oil seeds, from some of which the oil has been extracted with exceptional facility. There were also found species of wax, resin and fibre plants. A superior type of jute was found which was durable and strong ; also a variety which was tall strong, silky and with white fibres, similar to cotton, for which perhaps it might be substituted. A useful type of willow was also found. A species of straw was also abundant which has already been used for the making of hats in Brazil. Also, a great number of fibres of every description, one of which would prove particularly suitable in the manufacture of furniture. Plants containing tannin were also found, one of which would supply a tincture useful in dying silk a fine grey colour.

A species of *Taraktogenos Kurzii* (Chaulmoogra) but which a smaller size seed than the known variety is used by the natives for theurapeutic purposes KUHLMANN made aqueous extracts from the seed. A small species of Leguminosae is worth mention, a lucern which is easily cultivated, of rapid growth and high yield, not exacting as to soil, is of high nutritive value, and may be used for silage or hay. (*Paiz*, 16 July, 1924).

1148. **Foundation of the Brazilian Botanical Society** (*Sociedade Brasileira de Botanica*). — The Society was formed in March 1924, in order to establish laboratories, a library, herbarium, etc. The temporary headquarters are at rua Santa Alexandrina 124, Rio de Janeiro. (*Fazenda moderna*, Year IX, Nos. 2-3, 1924).

149. **Preservation of Birds and Animals in China.** — In the *China Journal of Arts and Sciences*, Vol. I, No. 5, is an interesting note on the necessity of adequate laws and the enforcement of such laws, for the protection of birds and animals in China in order that many valuable species may not be exterminated.

1150. **New Agricultural Review in the Far East.** — The editorial board of the "Lingnaam Agricultural Review" published by the Canton Christian College consists of six members, occupied respectively with agronomy, animal husbandry, chemistry, sericulture, horticulture and agricultural industries. The Review is issued twice a year. Annual subscription 2 dollars. Correspondance should be sent to the Editor, *Lingnaam Agricultural Review*, Canton Christian College, Canton, China.

1151. **Present Conditions of Cotton Growing in Egypt.** — According to the report of LINDEMANN and Co. of Dresden, cotton production has decreased in recent years. The area has increased somewhat since the War, but only 6250 000 kantars have been obtained, compared with 7 millions before the War. This may be attributed to exhaustion of the soil and to insect pests, particularly *Gelechia gossypiella*. There is a tendency in Egypt to substitute old species of Sakellaridis for other species less well adapted to existing conditions.

There is some danger of the loss of the Egyptian monopoly of Sakellaridis owing to the American varieties. There is something to be said as to the abandonment of Sakellaridis, but although the quality has declined and the yield has been reduced $^2/_3$ to 3 kantars per feddan, the species has not yet been satisfactorily replaced. In the Delta, Zagora and Ashmouni give about 4 kantars and in Upper Egypt, 5 kantars. Under the circumstances perhaps Sakellaridis might be restored to its former position, as its commercial value is 30 % higher than the two above varieties. (*Der Tropenpflanzer*, Year 27, No. 2, 1924).

1152. **Cotton Growing in the Argentine and the Mexican States.** — In Argentina, an increase was obtained in 1917-18. Previously the average production was 2-3000 tons per annum from 2-3000 hectares; in 1917-18 however, about 10 500 tons were obtained from about 12 000 hectares, and in the next two years this was extended to 13 000 hectares with a yield of 11 000 tons; in 1920-21, 24 000 hectares yielded 18 000 tons.

In the Mexican States the area under cotton was 113 000 hectares, with an average yield of 209 kg. per hectare. In Guatemala the yield is about 023 kg per hectare, but is less in the following Departments, in decreasing order, San Marcos, Zacapa, Retalhuleu, Suchitepequez. In Paraguay the yield for the present year is estimated at 10 million kilograms. (*Revista Económica de San Salvador*, Year XI, No. 5, 1924).

1153. **Cotton losses caused by fire in the United States.** — In the United States Department of Agriculture, Bulletin 271, Washington, 1923, it is stated that the system of placing ginneries below soil level has been shewn by experts to be a frequent cause of fires, due to static electricity. Three conditions are essential in order to obtain high charges of static electricity, viz. low atmospheric humidity; dryness of cotton; inefficient cleaning. A description is given of methods of prevention, which when adopted have led to the reduction of premiums by Insurance Companies (*L'Agronomie Coloniale*, Year X, No. 77, 1924).

1154. **Potash Output in the United States in 1923.** — In 1923 the United States produced 39 029 short tons of crude potash salts (20 413 tons of K_2O). Of this output, 32 243 tons of crude potash (17 982 tons of K_2O) were produced from mineral sources and 6 775 tons of crude potash (2 431 tons of K_2O) was

produced from organic sources. This output was made by eight companies operating 12 plants. The quantity sold was 35 164 tons of crude potash (19 281 tons of K_2O), valued at $7,84 671. Imports of crude potash into the United States in 1923 totalled 748 101 tons (209 581 tons of K_2O), valued at $15 354 755. Of this amount, 712 441 tons of crude potash (194 079 tons of K_2O), valued at $1 002 475, were used mainly in the fertiliser industry. (*Chemistry and Industry*, Vol. 43, No. 27, July, 1924).

1155. **Metric System in the United States.** — Prof. A. B. BEAUMONT has made a suggestion in favour of the extension of the metric system in the United States, namely, that the Agricultural Experiment Stations plot their experimental fields in metres. The transition is easy and involves no expense, since the metre is of the same order as the yard and as yields in kilograms per hectare correspond approximately to pounds per acre. (*Science*, Vol. LIX, No. 1537, June, 1924).

1156. **State Dairy Bureau.** — Inaugurated by decree dated 29 May, 1924.

1157. **United States Completion of Western Irrigation Scheme.** — The completion of the Texas irrigation scheme on the Wichita River is reported. The reservoir, called Lake Kemp will have a capacity of 171 517 500 000 gallons of water; sufficient for the irrigation of 100 000 acres of land in the Wichita Valley. Lake Kemp is the seventh largest artificial body of water in America. (*Scientific American*, July, 1924).

1158. **Irrigation in Hawaii.** — In the report of J. S. B. PRATT (Chairman of the Second Annual Meeting of the Association of the Hawaiian Sugar Technologists, (Honolulu, October, 1923), allusion is made to the development of overhead irrigation is connection with sugar cane cultivation. In this system, water is distributed by means of overhead pipes. The advantages claimed are that the amount of water is easily regulated; less water is required; there is no loss by seepage from the channels; cultivation is more easily carried out and there is less weeding; watering can begin immediately after the harvest; there is a great saving in labour; protection against fire is provided. On the other hand, the cost is heavy, amounting to $150-200 per acre. (*International Sugar Journal*, Vol. XXVI, No. 306, 1924).

1159. **Chemical Research activity in various parts of the World.** — E. J. CRANE, of the Ohio State University, Columbus, U. S. A., has based his data on Chemical Abstracts compiled from figures for 1915-1917-1918-1923. It may be noted that the United States still retains its lead, taken from Germany for the first time during the War. European countries have, however, recovered to a considerable extent, although the significant gain in America has been confirmed by Dr. J. C. IRVINE of Scotland at the New Haven Meeting of the American Chemical Society in 1923, when it was stated that " the centre of chemistry has moved to America ".

It should be noted further that the British chemists have maintained a steady productivity and that France and Germany have recovered well from their considerably lowered percentages during the War. This applies also to Belgium. The recovery of Austria and Russia has been slower. Japan is gaining in importance. Czecho-Slovakia and Poland, Roumania and China are also showing chemical activity. (*Industrial Engineering Chemistry*, Vol. 16, No. 7, p. 54. Washington, 1924).

1160. **Rural Life in the United States.** — "Lange Agricultural Island", pp. 112. Clayton, N. J., 1923, gives information relative to rural education of the white and black races, and country social conditions in the United States.

1161. **United States.** — The summer number of *World Agriculture* makes a special feature of the work of the VIIth General Assembly of the International Institute of Agriculture held in May last and gives a summary of the more important results of the Session. An account is also given of the Fourth International Soil Science Congress, which took place at the Institute immediately after the Meeting of the General Assembly and of which a detailed report was contained in the last number of this Review. There are in addition articles dealing with special phases of the activities of the Institute and with the proposal to form an International Organisation of Farmers' Associations, which is closely associated with the name of Dr. Ernst LAUR, President of the Swiss Peasants' Union, and was favourably received in discussions which took place in connection with the General Assembly of last May.

The Summer or "Rome" number of this publication, the organ of the World Agriculture Society (Amherst, Mass.), is as usual, admirably illustrated and, as will be gathered from the above, is of special interest to readers of the International Review of Agriculture.

1162. **On the Manufacture of Synthetic Ammonia in France.** — In 1919 the French Government arranged with the "Badische Anilin" for the manufacture of synthetic ammonia by the Haber process. The Senate suggested that a Society should be formed, composed of those interested in the matter, especially farmers, for the exploitation of this process. The Senate further expressed the desirability of making a contract with the "Badische Anilin" and the "Office national industriel de l'azote" with a view to the exclusive manufacture of nitrogenous products and by-products. This measure was approved by the Chamber on 5 April. The Nitrogen Company has the power to adopt or dispose of any new method or patent, on approval of the Ministry of Public Works and Finance.

The Society of Chemical Industries in France has formed a Syndicate called "Ammonia" for the production of synthetic ammonia. Factories have already been started in the Departments du Nord and it is the intention to open others in the valley of the Loire, which is rich in coal strata. The daily production is estimated at 750 quintals. Three methods of manufacture are adopted: CLAUDE's process; HABER's method, modified; the catalytic method of CASALE. (*Bulletin de la Société des Agriculteurs de France*, Year 38, No. 4, April, 1924).

1163. **National Bureau of Documentation of Applied Chemistry.** — It has been decided to establish an Institute in France to co-ordinate information and material respecting: pure chemistry, laboratory and furnace equipment, combustion, metallurgy and mineralogy, organic industries, agronomy and agricultural industries; economic organisation. It is proposed that the Bureau should possess a repertoire of: — bibliographies; schedules of analyses; references; chemical samples; raw materials and manufacturing products; specimens; research archives; commercial notices and catalogues. (GERARD, in *Chimie et Industrie*, March, 1924).

1164. **Uniform Classification of granulated and powdered Materials.** — A special commission of standardisation based on the study of reliable samples of materials has promulgated a series of standards, expressed in simple terms which serve as a basis for measurement, in order to obtain uniformity. In the *Bulletin de la Société d'encouragement*, April 1924 (p. 373). M. R. FERET, of Boulogne-sur-Mer has based a uniform classification of granulated and powdered materials along these lines, and the Society has opened a discussion as to their practical application.

1165. **On French Legislation dealing with Accidents incurred during Agricultural Work.** — Mr. J. COSTE-FORET notes the responsibility of the French Government in connection with such accidents. (*a*) Certain enterprises are considered intermediate between industry and agriculture (butter factories, sugar factories, etc.). These may be considered from two aspects : 1) those connected with agricultural undertaking ; 2) that the agricultural undertaking in question occupies the chief position in respect to the industry. (*b*) As regards agricultural motors the law of 15th Dec. 1922 is applicable when : 1) the motors are the property of the agricultural undertaking ; 2) the said motors are utilised for farm requirements, 3) the chief of the undertaking himself is subject to the regulations enforced (law of 15 December 1922).

On the contrary, it is the law of the 30th of June 1899 which would apply in the case of a thresher and a subsoiling plough hired by the proprietor. In order to avoid any complications on the part of the proprietor, the insurance of the mechanics and the employees is essential. (*Revue de Viticulture*, Year 31, Vol. LX, No. 1563, Paris, 1924).

1166. **Milk Production in France.** — As a result of the enquiry made by the Ministry of Agriculture in 1924, the following data is available : 1921, 106 503 550 hectolitres ; 1922, 113 276 970 hl. ; 1923, 117 038 120 hl. The differences between the years 1913 and 1923 are as follows :— 1913, 28 986 430 hl. as cattle food, 43 369 180 hl. as butter and 14 589 430 hl. as cheese ; 1923, 25 536 830 hl., 38 972 450 hl. and 22 330 170 hl. respectively. (*Bulletin de la Société des Agriculeurts de France*, Year 56, No. 4, April, 1924).

1167. **Centenary of Alcometry, France.** — An interesting pamphlet has recently been issued by M. J. DUJARDIN, entitled *Centenaire de l'Alcoométrie et de l'Alambic de Gay-Lussac, Leur évolution*, pp. 60. 24, rue Pavée, Paris (4). The chapters include :— history of alcometry ; résumé of the history of alcometry ; biography of Gay-Lussac ; report of the Chaptel on alcometry ; report of Gay-Lussac on brandy ; information on alcometry ; correction tables and their applications ; the alambics of Gay-Lussac and of Salleron ; official method of estimation. (*Revue de Viticulture*, Year 31, Vol. LX, No. 1564, Paris, 1924).

1168. **Map showing the vine districts of France.** — Under the direction M. G. COUANON (Inspecteur général de la viticulture), a coloured map has been published showing all the vine districts of France, with an accompanying list of the chief varieties grown. The map measures 9 cm. × 1.20 metres and may be obtained from the Librairie H. BARRIÈRE, 21 rue du Bac, Paris. (*Le progrés agricole et viticole*, Year 41, Vol. LXXXI, No. 24, June, 1924).

1169. **The Forest Service in Indo-China.** — The forest area of Indo-China (Tonkin, Annam, Cambodia, Cochin-China, and Laos) covers 315 000 km.²

out of a total of 700 000 km.². The forest regions are divided into two sections : reserved and protected. The first consists of forests under State control and supervised by the "Service Forestier". This extends over 1 600 000 hectares and consists of : (1) forests which cannot be exploited (to be considered later) ; (2) forests exploitable but which might be improved ; (3) forests exploitable immediately. Special concessions are made for the last section on condition that they are utilised within 20 to 30 years. For this purpose special sawmills have been set up in the forests (South Annam, Cochin-China).

In the protected area the forester is allowed to fell the trees of the diameter specified (excepting very rare species which it is forbidden to touch).

The forest service staff consists of 180 Europeans and 681 natives. In addition to the central service, the sub-divisions of each region are under the supervision of a chief inspector.

The internal timber trade is very considerable. Insufficient is produced in Tonkin and Cochin-China to meet requirements. Tonkin imports from N. Annam large quantities of "lim" and "gu", while Cochin-China imports from South Annam and Cambodia exports 70 %. The export is insignificant and is limited to small quantities of wood for furniture. (A. MAGNIEN, Les forêts indochinoises, *Revue des Eaux et Forêts*, Vol. LXII, No. 7, Paris, July, 1924).

1170 **Stock Census in France.** — According to the figures published in the *Journal Officiel*, 28 March, 1924, which refer to the year 1923, it will be noted that, compared with 1922 the number of horses has increased to about 70 000 head and the mules to 6 000 head ; the asses have on the contrary decreased by 700 head. An increase of 173 000 head of cattle (134 000 cows and 29 000 calves) is also reported. Comparisons are made with pre War figures (1913) ; for example, in Alsace-Lorraine the cattle census in 1913 showed 14 757 710 head, whilst in 1923 the number had decreased to 13 749 200 head.

For sheep and pigs, an increase of 143 000 and 221 000 head respectively is shown.

1171 **Great Britain. The Phytopathological Service of England and Wales.** — Immediately before the War, in 1914, there were two organisations engaged, or destined to be engaged in the fight against plant pests and diseases — a small body of Government officials under the Board of Agriculture, whose main duties were to administer the Destructive Insects and Pests Act, and another Body of scientific workers paid from Government funds but not Government officials, who were appointed to conduct research, investigation and advisory work throughout the country. The Service to-day consists of two main sections : (1) the official section attached and controlled directly by the Ministry of Agriculture (previously the Board of Agriculture) ; (2) the non-official section, distributed through the various Universities, Agricultural Colleges and Research Institutes of the country, financial provision for which comes from Government funds, but which is free from the detailed instructions of the Ministry and subject only to a certain amount of supervision to ensure efficiency.

The pests and diseases of forest trees for timber production are dealt with by the Forestry Commission.

The official section is divided into three units :— 1) the Fruit-pest

Laboratory at Harpenden which has a small entomological and mycological staff, 2) an administrative unit forming an integral part of the Horticultural division of the Ministry in London ; 3) the Ministry's Inspectorate, about 30 members of which have special qualifications with regard to plant pests and diseases, although these officers are not exclusively employed on such matters.

The non-official side consists of : 1) the Phytopathological Research Institute attached to the Rothamsted Experiment Station at Harpenden, and also scientific workers attached to specialised research stations such as the Long Ashton Fruit Station, Bristol ; the Imperial College of Science, London ; the Fruit Station at East Malling ; the Lea Valley Station , Cheshunt ; the Department of Helminthology of the London School of Tropical Medicine ; 2) the corps of advisers consisting of an entomologist and a mycologist in each agricultural province, 14 in number.

The Government grants in aid of the work detailed under the two preceding sub-sections are administered by the research branch of the Ministry of Agriculture.

The advisers assist farmers and growers within their respective provinces. They carry out experiments on the practical control of pests of local importance and render the results of their work available to the industry. They are assisted in this work by members of the county educational staff, such as the county agricultural organisers and the horticultural superintendents, and are engaged in research on fundamentals, e. g. the physiological action of insecticides and the nature of resistance and immunity to disease.

The Pathological Laboratory at Harpenden has as its main function the provision of a scientific basis for the Orders issued under the Destructive Insects and Pests Acts, and is responsible for other special work required in connection with legislation of this type. Also it acts as the co-ordinating centre for the whole service. (J. C. F. FRYER and G. H. PETHYRIDGE, *Journal of the Ministry of Agriculture*, Vol. XXXI, No. 4, 1924).

1172. **The Eastern Countries Farmers' Co-operative Association, England.** — This Association is an amalgamation of farmers numbering about 3000, the majority of whom reside in the Eastern counties of England, the driest of the British Isles. Owing to the increasing demand for seed of greater purity, higher germination and reliable strains, a valuable seed cleaning establishment situated at Ipswich, is in full working order under the direction of this Association. The aim is to forward clean and reliable stocks from the British farmers to all parts of the world at the lowest possible cost. The Association is prepared to grow by contract almost any seed and to sell at a very small margin of profit.

A special feature of the seed cleaning is the magnetic dodder plant which has caused very wide interest (see *The Journal of the Ministry of Agriculture*, Vol. XXX, No. 10, pp. 930-931. London, 1924). " A new process has been recently discovered by which the removal of the large seeded dodder from clover seed is easily effected..... and should enable the cleaner to remove *Cuscuta racemosa* as easily and economically as he now removes *Cuscuta Trifolii* by the sieve method . . . The seed is mixed with a magnetic powder and more of this adheres to the rough coats of the dodder seeds than to the smooth coats of the clover seeds. The seed is then passed under a magnet which

draws out the seeds bearing sufficient of the powder to be magnetically attracted. By this means not only can an absolute elimination of dodder be made but there are also removed, broken seeds whose rough surfaces hold the powder and rough coated weed seeds. The clover seed is then put through a polisher to remove adhering powder." This is said to be the only successful method of removing all *cuscuta* from seeds.

The other machines for cleaning and separating apply to clovers, sainfoins, lucerne, rye grasses, lawn grasses, swedes and turnips, seed mixtures for temporary and permanent pastures, marigolds, linseed, and the natural grasses (e. g. *Dactylis glomerata*, *Phleum pratense*, *Festuca*, spp. *Poa* spp., *Avena elatior*, *Cynosurus cristatus*, *Achillea millepodium*, *Poterium sanguisorba*, *Cichorium Intybus*).

A few typical examples of machinery methods thus employed may be given:— Treating hard seeds in clovers; removing *Geranium molle* from white clover; cleaning trefoil, before and after milling; method of eliminating possible errors when retailing seeds of similar characteristics.

In connection with the Seed Cleaning Establishment are the cultivated seeds (chiefly of forage crops) and weed seeds plots, where practical tests are continually being made.

1173. **The Fourth Annual Report of the Forestry Commissionors for the Year,** states that during that the period 10 463 acres were planted with about 18 000 000 trees, mostly conifers, at an average cost of £7 per acre; this figure included preparation of ground, draining, fencing, planting, replacing blanks and weeding. The total land acquired during the four years amounts to 179 207 acres of which 121 015 are classified as plantable; in addition 120 000 acres of Crown woods have been transferred in 1923 from the Commissioners of Woods to the Forestry Commissioners. Two schools for training woodman have been established, also 143 experimental plots. The report contains a full account of resolutions passed at the British Empire Forestry Conference held in Canada in 1923. (*Nature*, Vol. 114, No. 2857. London, 1924).

1174. **Carbonisation of Seaweed as a Preliminary to the Extraction of Iodine and PotassiumSalts.** — Report of investigations made by H. M. Fuel Research Station. (J. C. KING, H. M. Stationery Office, London).

1175. **Water Power Resources of Canada.** — The Water Power Branch of the Canadian Department of the Interior has recently issued a report dated February 1st, 1924, which reviews the present position of development. In 1923, there was an increase of more than a quarter of a million horse-power, and the hydraulic power installations of the country now aggregate a total of 3 227 414 h. p. The known available water power from all sources is computed at 18 255 000 h. p. for conditions of ordinary flow, and at 32 070 000 h. p. under a flow which can be depended upon for at least six months in the year. These estimates are of a conservative character; from estimations of existing plant it is found that the average machinery installation is 50 % greater than the six months' flow at maximum power. It is of interest to note that the existing installations comprise:— 2 411 761 h. p. in central stations, for general distribution for all purposes (average installation about 85 h. p.); 617 [illegible] h. p. in pulp and paper mills (exclusive of 22 8153 h. p. purchased by pulp and

paper companies from central stations) ; 318 093 h. p. in industries other than central stations and pulp and paper mills.

The total installation for the Dominion averages 353 h. p. per 1000 of population, Canada thus ranking, amongst the countries of the world, third to Norway and Switzerland in the *per capita* utilisation of water power. The report expresses the view that there is every reason to expect a continued and rapid development of water power. At the present time there are actually in process of construction, or in active prospect, hydro-electric plants aggregating 900 000 h. p. On a moderate estimate, the effective working increase will be at the rate of one million h. p. every 5 years, so that by the year 1940 no less than 7 million h. p. should be developed. The cost of the existing installations represents a capitol outlay of more than 687 000 000 dollars, which in 15 years' time on the same basis of increase, will reach $1 500 000 000. (*Nature*, Vol. 113, No. 2848, May 31, 1924).

1176. **Yield of Sesame, Rape, Hemp and Flax in India, 1923-24.** — The sesame yield is calculated at 431 000 tons from an area of 5 018 000 acres. From reports received from the various provinces and referring to about 99 % of the total area cultivated with rape, mustard and flax, it is seen that there is a diminution of 4 % in the period 1923-1924, when compared with the previous year, for rape and mustard, and of about 13 % for flax. (*Indian Trade Journal*, 24 April and 29 May, 1924).

1177. **Ex-German Territory in the Cameroons.** — The Ministry of Colonial Affairs has suggested that former German territory should be sold by public auction and the proceeds used for reparation in British interests. (*Kolonial Warte*, 30 May, 1924).

1178. **Trade in ex-German Papua.** — In New Guinea (ex-German), exports from 1919-21 show a decrease of copra of 49,8 %, cacao 43.75 % and an increase for exports of birds of Paradise, 35,3 %, of mother of pearl and tortoise hell, 550 %. An icnrease also of import of liquid fuel, 440 %, tobacco 106 %, alcohol 130 %, food materials 26 % ; a decrease in the import of clothing of 90.5 %, metals and machinery of 57 %.

1179. **Enquiries into Agricultural Methods in Italy.** — The Ministry of National Economy is making enquiries respecting agricultural activity throughout the Kingdom, in order to obtain the material necessary for the study of codification and direction of Italian agriculture.

1180. **New German Review on Stock Breeding and Biology.** — The first number was published in last May under the editorship of O. PAREY, Berlin, of the *Zeitschrift für Tierzuchtung und Zuchstundsbiologie*, under the direction of KRONACHER, Hanover, assisted by well known scientists.

1181. **Regional Forestry Maps of Italy.** — The IX Geographical Congress in Italy held in Genoa on the initiative of the Pro Montibus of Udine and Bolonia, has authorised the Comitato Geografico Nazionale to nominate a sub-Commission of specialists to prepare a plan for the execution of section maps applicable to all Italy.

1182. **The work of Agostino Bassi.** — A treatise will shortly be published on the work of the well-known naturalist, the precursor of modern bacteriology and antiseptics, who has carried out work on silk cocoons, and on fungal contagion as the specific agent of disease ; on the designation of the chief

disinfectants both chemical and physical, and his conception of contact relative to human disease.

1183. **Turpentine in the Dutch Indies.** — In N. Sumatra at Aljeh are found vast stretches of *Pinus Merkusii*. The turpentine obtained from these trees is of high quality and investigations are in progress to test the advantages of methods of extraction used in other countries. (*De Indische Mercuur*, Year 47, Nos. 12-17, 1924).

1184. **Irrigation in Northern Peru.** — Data are given by R. Stappenbeck respecting the Rio Chicama, which irrigates about 3000 hectares, 70 % of which is devoted to sugar cane, and the remainder to cotton and rice. In this area are found the larger sugar factories of South America. The unit for irrigation is 1 cub. metre of water per minute. The distribution is carried out by a network of canals, the loss of water by evaporation and leaching being estimated at about 32 % ; nevertheless, the land becomes saturated. Attempts have recently been made to utilise subterranean water for irrigation. On the Hacienda Casa Grande, irrigation is needed in February and March. On an average, irrigation is used for 27 hectares of sugar cane or 32 ha. of meadow ; in the months of September and December, irrigation is used over the maximum area. (*Zeitschrift d. Ges. für Erdkunde*, Nos. 1-2, Berlin, 1924).

1185. **Potash and Superphosphates in Poland.** — According to a report of the U. S. Commercial Attaché at Warsaw, the Polish production of potash salts in 1923 was 61 494 tons (46 082 tons in 1922), including 22 119 tons of kainit (2520 tons in 1922). The output of salt rose from 295 000 tons in 1922 to 363 397 tons in 1923. There are 16 superphosphate factories and two more are being built, but only 12, employing 3000 workers, are producing. The output from 6 of these factories is said to be about 67 000 tons. (*Chemistry and Industry*, Vol. 43, No. 27, July, 1924).

1186. **Distillation of Wood in Russia.** — This industry is under the control of the Nitro-Methyl Trust. According to the *Metall Borsa*, October 16, 1923, the Trust sold in July-August, 1923, 10 000 puds (1 pud = 16.5 kg.) of acetic acid and 2500 pud of formaldehyde. The value of the products amounted to 96 000 gold roubles in the month of July and 110 000 in August ; from August and September, 1923 the prices of this Trust have risen about 30 %.

1187. **Suggestion for the Regulation of the Timber Exchange in Moscow.** — The necessity for establishing a commercial code which will safeguard trade interests has been recognised in Russia. It has been proposed *a*) to keep a firm control on the trade in timber ; *b*) to classify the principal types of timber ; *c*) to study the conditions proved best for timber production. It has been considered advisable to establish trade contracts, to stabilise conditions of sale and purchase. The question of exchange demands attention. The difficulty at present lies in the drawing up of technical regulations respecting timber, owing to the difficulties raised by producers who maintain that such regulations would hinder the timber trade. On the contrary, the conditions now in force assist the industry, provided that all parties concerned are fully aware of the conditions. Cases of disagreement could be referred to the Court.

Gittler states that the project is still incomplete and points out the benefits of its application. He adds that the regulations were drawn up for the central market of Moscow, which has caused discontent amongst other Russian

merchants. GITTLER states however, that the Moscow trade represents 30 % of the total, and adds that necessary modifications will be made in order to meet the various conditions.

1188. **Forest Concessions of the Russian Soviet.** — Important concessions have been made as follows :— *a*) Volga-Caspian (Governments of Tsarystine, Samara and Astrakan) to the Volga-Caspilless, which possesses 16 saw mills with 132 saws ; *b*) Kama-Uralica, 12 million desiatines, 13 200 000 ha. in the region of the Urals to the Kamauralboumstrust, with 20 saws, 6 cellulose factories, 20 stores for wood fibre ; *c*) Duna del Nord, 123 687 des. of the Government of Vitebsk, Smolensk and Pskov, to the Dvinoliess ; *d*) Bois du Nord 54 250 000 des. in the Region of White Sea, to the Severoliess and another 4 million des. for those connected with the Trust. The Trust possesses 43 stores and mills including 25 sawmills with 109 saws. of which 23 are in running order, (*Izviestia*, 20 March, 1924).

1189. **Union Suisse des Paysans.** — The annual report refers to the work done by this Society in 1923. The Union consists of 52 sections with 382 190 members, and is well supported by the Swiss Agricultural Associations. The permanent organisation is the Secretariat Suisse des Paysans, under the direction of Dr. E. LAUR.

Details of the course in accountancy held regularly at Brugg since 1921 are given. During the summer and autumn, the accounts are examined and verified and at the close of the year the books are sent to the Secretariat for control. There are certain cases where the same accounts have been controlled thus for more than 20 years.

1190. **Personal Information.** — * The death of Dr. J. LOEB in February last in Bermuda, has meant the loss of a valuable contributer to physiological and biological research. Born at Mayen (Germany) in 1859, Dr. LOEB followed a course of studies at Berlin, Munich and Strasburg, becoming later assistant in Physiology, first at the University of Wurtemburg (1886-88) and then at the University of Strasburg (1888-90). This was followed by classical studies of marine biology at the Zoological Station, Naples, and later in the United States, being nominated in 1892 as Professor of Experimental Physiology and Biology, at Chicago. In 1902 he transferred to the University of California and in 1910 was elected a member of the Rockfeller Institute. For the last ten years, his time has been given exclusively to protein investigations. Amongst other works published should be mentioned : Comparative Physiology of the Brain and Comparative Psychology (1900) ; Studies in General Physiology (1905) ; Dynamics of Living Matter (1906) ; The Mechanistic Conception of Life (1912) ; Artificial Parthenogenesis and Fertilisation (1913) ; The Organism as a Whole (1916) ; Forced Movements, Tropisms and Animal Conduct (1918) ; Proteins and the Theory of Colloidal Behaviour (1922) ; Nature Physico-chimique de la régéneration (1924).

Prof. Albert HESSE died on the 10th May, 1924 at Berlin-Wilmersdorf. His name is closely associated with the *Chemischen Centralblatt*, of which he was Editor, a publication which is wellknown for information concerning all branches of pure and applied chemistry. Especially worth mentioning are studies on oils, ethers, perfumes and particularly essences of rose, geranium, carnation, camphor, etc.

* Dr Norberto LORENZ of Fiume, Councillor of State, has recently died at Salzburg. He was formerly attached to the "Landwirtschaftliche Chemische Versuchsstation" at Vienna, and was then at the "Forstliche Versuchsanstalt" (Forest Experiment Station) at Mariabrunn. He is well known for his investigations on nitrogen, and for his "hydrobion" for the transport of fish which will shortly be patented.

* Sir James J. DOBBIE, lately Government Chemist and formerly Director of the Royal Scottish Museum, Edinburgh, died in June 1924, at the age of seventy-five years. Born in 1852, Sir James DOBBIE has completed a successful scientific life and early in his career was nominated Professor of Chemistry at *University College of North Wales, Bangor*.

* Dr. William James BEAL died on May 12, 1924 at Amherst, Massachusetts in his 92nd year. He was one of the earliest students of Louis AGASSIZ of Harvard College. For over 50 years he had been a teacher of science first at the University of Chicago and later for 40 years he was Profesor of Botany at the Michigan Agricultural College. Amongst other important works published may be mentioned especially, the two volumes on the "Grasses of North America". He is recognised as a pionneer in the new methods of scientific education, and was the first President of the Society for the Promotion of Agricultural Science, and Director of the Michigan State Forestry Commission, and President of the Michigan State Teachers' Association, and an energetic member of the Botanical Society of America, the American Pomological Society and other scientific organisations.

* Prof. Dr. Oscar BREFELD of Berlin, Secretary of State since 1905, attached to the Botanical Faculty of the University of Breslau, and well known as a mycologist, has recently died at the age of eightyfive years.

* Prof. Edouardo PERRONCITO, the celebrated parasitologist of the University of Turin, received the honorary degree of the Academy of Medicine, Paris, last March, presented by M. STRAUSS, Minister of Hygiene and of the Academy of Agriculture.

* The *Institution of Electrical Engineers* has presented the Faraday medal to Director Z. DE FERRANTI. This is the third time that he has been thus honoured.

* The LIEBIG medal has this year been awarded to Max SCHRODER in recognition of his improvements in the manufacture of liquid sulphuric acid and of sulphuric acid by the contact process.

ALFREDO RUGGERI, *gerente responsabile*.

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The index has been compiled by Miss M. L. Yeo

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III — PLANT DISEASES

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